Siemens Moore Process Automation, Inc.	**USER'S MANUAL**

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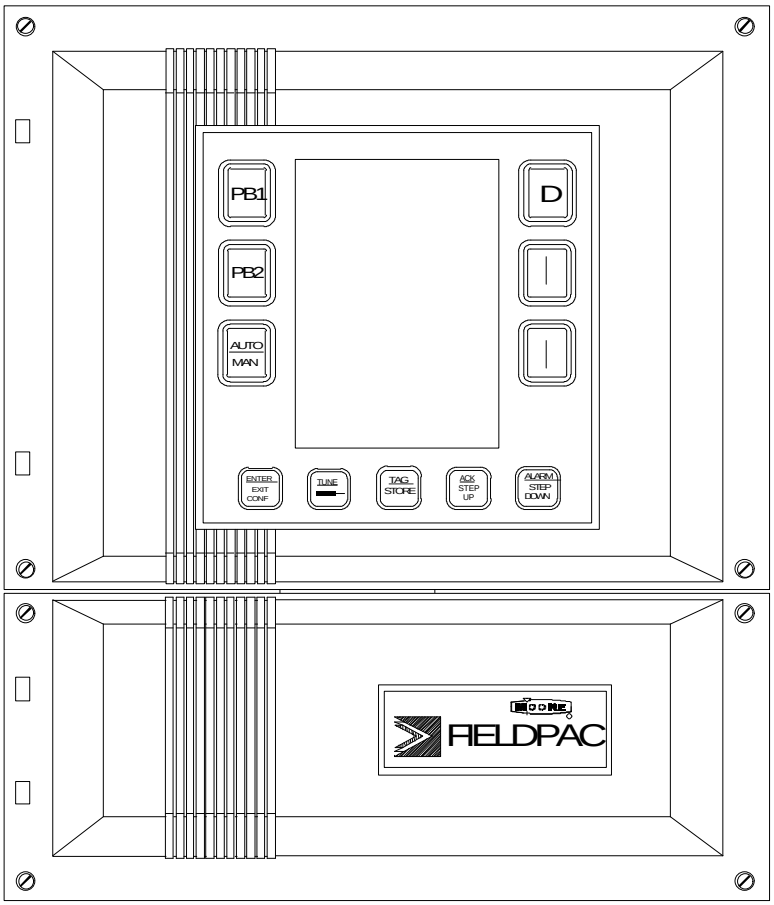

Moore 348 FIELDPAC™
FIELD MOUNTED CONTROLLER

TABLE OF CONTENTS

SECTION	TITLE	PAGE
1.0	**INTRODUCTION**	1-1
1.1	PRODUCT DESCRIPTION	1-1
1.2	MODEL DESIGNATION	1-2
1.3	SPECIFICATIONS	1-2
1.3.1	Mechanical	1-2
1.3.2	Electrical	1-6
1.3.2.1	Power Requirements	1-6
1.3.2.2	2-Wire Transmitter Supply Power	1-6
1.3.3	Input/Output Ports	1-6
1.3.4	Environmental	1-10
1.3.5	Hazardous Area Classification	1-11
1.3.5.1	FM/CSA Hazardous Location Precautions	1-11
1.3.5.2	CM (EMC) Compliant Considerations	1-12
1.3.5.3	BASEEFA Ex N IIC T5 Considerations	1-13
1.3.6	Two-Wire Cable for HART® Communication	1-13
1.4	ACCESSORIES	1-15
1.5	PRODUCT SUPPORT	1-16
2.0	**INSTALLATION**	2-1
2.1	INSTALLATION CONSIDERATIONS	2-1
2.2	ENVIRONMENTAL CONSIDERATIONS	2-1
2.3	MECHANICAL INSTALLATION	2-5
2.3.1	Panel Mounting	2-5
2.3.2	Pipe Mounting	2-6
2.3.3	Wall Mounting	2-6
2.4	ELECTRICAL INSTALLATION	2-7
2.4.1	Conduit Installation	2-7
2.4.2	Wiring Guidelines	2-8
2.4.3	Terminal Connections	2-9
2.4.3.1	Power Connections	2-11
2.4.3.2	Signal Inputs And Outputs	2-12
2.5	PNEUMATIC CONNECTIONS	2-17
2.5.1	Pneumatic Inputs	2-17
2.5.2	Pneumatic Output	2-17
2.5.3	Direct Pressure Input	2.17
2.6	FACTORY CALIBRATION	2-20
2.7	CONFIGURATION	2-21
3.0	**OPERATION**	3-1
3.1	FACEPLATE	3-1
3.1.1	Liquid Crystal Display Panel	3-1
3.1.1.1	Multifunction Alphanumeric Display	3-1

TABLE OF CONTENTS
(Continued)

SECTION	TITLE	PAGE
3.1.1.2	Setpoint And Process Vertical Bargraphs	3-2
3.1.1.3	Valve or Output Horizontal Bargraph	3-2
3.1.1.4	PB1 And PB2 Triangle Indicators	3-2
3.1.1.5	AUTO/MAN Triangle Indicators	3-2
3.1.2	Control Pushbuttons	3-3
3.1.2.1	PB1	3-3
3.1.2.2	PB2	3-4
3.1.2.3	AUTO/MAN	3-4
3.1.2.4	D	3-4
3.1.2.5	UP Arrow	3-4
3.1.2.6	DOWN Arrow	3-4
3.1.3	Dual Function Pushbuttons	3-5
3.1.3.1	ENTER/EXIT CONF	3-5
3.1.3.2	TUNE/--->	3-5
3.1.3.3	TAG/STORE	3-5
3.1.3.4	ACK/STEP UP	3-6
3.1.3.5	ALARM/STEP DOWN	3-6
3.2	OPERATING MODES	3-6
3.3	DISPLAY TEST	3-6
3.4	PUSHBUTTON CARE	3-7
3.5	CONTRAST ADJUSTMENT	3-7
4.0	**CALIBRATION**	4-1
4.1	GENERAL CONSIDERATIONS	4-1
4.2	REQUIRED EQUIPMENT	4-2
4.3	LOCKOUT SWITCHES	4-3
4.4	ESN ASSIGNMENT	4-3
4.5	ANALOG INPUTS AND OUTPUTS	4-4
4.6	PRESSURE SENSOR INPUT	4-8
4.6.1	Mounting Position Zero Shift Calibration	4-8
4.6.2	Calibration Verification	4-9
4.7	TEMPERATURE SENSOR INPUT	4-10
4.7.1	Selecting Input Type	4-11
4.7.2	Specifying Measured Variable Units	4-12
4.7.3	Millivolt Input Calibration	4-14
4.7.4	Thermocouple Input Calibration	4-17
4.7.5	RTD Input Calibration	4-20
4.8	PNEUMATIC INPUT	4-24
4.9	I/P MODULE CALIBRATION	4-26

TABLE OF CONTENTS
(Continued)

SECTION	TITLE	PAGE
5.0	**CIRCUIT DESCRIPTION**	5-1
5.1	MPU CONTROLLER BOARD	5-3
5.2	PLUG-IN AC POWER SUPPLY	5-6
5.3	DISPLAY/KEYBOARD ASSEMBLY	5-6
5.3.1	Display/Interface Board	5-6
5.3.2	Keyboard	5-7
5.4	TEMPERATURE SENSOR BOARD	5-7
5.5	PNEUMATIC INPUT BOARD	5-8
5.6	I/P MODULE	5-9
5.7	PRESSURE SENSOR	5-9
5.8	HART SIGNAL PORT	5-10
6.0	**MAINTENANCE**	6-1
6.1	TOOL AND EQUIPMENT REQUIREMENTS	6-1
6.2	PREVENTIVE MAINTENANCE	6-1
6.2.1	Environmental Considerations	6-1
6.2.2	Visual Inspection	6-1
6.2.3	Cleaning	6-2
6.2.4	Circuit Board Handling	6-2
6.3	FUSE LOCATION	6-2
6.4	TROUBLESHOOTING	6-2
6.4.1	Error Codes	6-3
6.5	ASSEMBLY REPLACEMENT	6-5
6.5.1	Upper Door Assembly	6-7
6.5.2	Terminal Compartment Cover	6-10
6.5.3	AC Power Supply	6-11
6.5.4	Temperature Sensor Board	6-12
6.5.5	Pneumatic Input Board	6-14
6.5.6	Pneumatic Output Board	6-16
6.5.7	Direct Pressure Sensor Input	6-17
6.5.8	MPU Controller Board	6-18
6.6	RECOMMENDED SPARE AND REPLACEMENT PARTS	6-21
6.7	MAINTENANCE RECORDS	6-21
6.8	TO RETURN EQUIPMENT	6-21
7.0	**CONFIGURATION**	7-1
7.1	CONFIGURATION MODES	7-1
8.0	**FUNCTION BLOCK DESCRIPTIONS**	8-1

TABLE OF CONTENTS
(Continued)

SECTION	TITLE	PAGE
9.0	**CONFIGURATION**	9-1
9.1	FCO 00 ESN Reset (ESN=00)	9-2
9.2	FCO 01 Single-Loop PID Controller (TSP)	9-2
9.3	FCO 02 Single-Loop PID Controller (NTSP)	9-6
9.4	FCO 03 External-Set PID Controller (TSP)	9-10
9.5	FCO 04 External-Set PID Controller (NTSP)	9-14
9.6	FCO 05 Ratio-Set PID Controller	9-18
9.7	FCO 10 Default Configuration	9-22
9.8	FCO 11 Single-Loop PID Controller (TSP) - C/L Operation	9-32
9.9	FCO 12 Single-Loop PID Controller (NTSP) - C/L Operation	9-36
9.10	FCO 13 External-Set PID Controller (TSP) - C/L Operation	9-40
9.11	FCO 14 External-Set PID Controller (NTSP) - C/L Operation	9-44
9.12	FCO 15 Ratio-Set PID Controller - C/L Operation	9-48
9.13	FCO 20 Single Station Cascade Controller (TSP)	9-53
9.14	FCO 25 Dual-Loop PID Controllers (TSP)	9-58
9.15	FCO 26 Dual-Loop PID Controllers (NTSP)	9-64
9.16	FCO 31 Single-Loop PID Controllers (TSP) with Pressure Input	9-70
A.0	**APPENDIX A - FIELDPAC FUNCTION BLOCKS**	A-1
B.0	**APPENDIX B - MODEL 348 CONFIGURATION DOCUMENTATION**	B-1
C.0	**APPENDIX C - CABLE CAPACITANCE AND MAXIMUM LENGTH**	C-1
WARRANTY		W-1
Parts List		348-1PL

LIST OF ILLUSTRATIONS

FIGURE	TITLE	PAGE
1-1	Model 348 Field Mounted Controller (FIELDPAC)	1-3
1-2	Model 348 Dimensions, Process Pressure Input Models	1-4
2-1	Pipe Mounting Details	2-2
2-2	Panel Mounting Dimensions	2-3
2-3	Typical Wall Mounting	2-4
2-4	Conductor Connection to Terminal Block	2-9
2-5	Electrical Connections	2-10

TABLE OF CONTENTS
(Continued)

SECTION	TITLE	PAGE
2-6	Model 348 Terminals	2-13
2-7	Digital Output to Typical Loads	2-15
2-8	RTD Wiring Connections	2-16
2-9	Model 340D Differential Pressure Sensor	2-18
2-10	Model 340A and Model 340G Pressure Sensors	2-19
2-11	Differential Flow Measurement Piping for Gas and Liquid	2-21
2-12	Absolute or Gauge Pressure Measurement	2-22
2-13	Steam Service, Below the Line Mounting	2-23
3-1	Operator Controls and Signal Displays	3-3
3-2	Display Contrast Adjustment	3-7
4-1	Thermocouple and Millivolt Input Calibration Wiring	4-15
4-2	I/P Module	4-29
5-1	Model 348 Hardware Architecture	5-2
5-2	MPU Controller Board Inputs and Outputs	5-4
5-3	MPU Controller Board Physical Layout	5-5
5-4	Temperature Sensor Board Block Diagram	5-8
5-5	Pneumatic Input Board	5-9
5-6	Transducer Module Circuit Diagram	5-11
6-1	Upper Door and Terminal Compartment Cover	6-7
6-2	Upper Door Assembly	6-8
6-3	Rear View of Hinge Assembly	6-9
6-4	Power Supply Removal/Installation	6-12
6-5	Temperature Sensor Board Removal/Installation	6-13
6-6	Pneumatic Input Board	6-15
6-7	Pneumatic Output Board	6-16
6-8	Direct Pressure Sensor Input	6-18
6-9	MPU Controller Board	6-20

LIST OF TABLES

TABLE	TITLE	PAGE
1-1	Model Designation	1-5
1-2	Accessories for the FIELDPAC	1-15
1-3	TIC Contact Information	1-17

TABLE OF CONTENTS
(Continued)

TABLE	TITLE	PAGE
3-1	Status Information	3-2
4-1	Analog I/O Calibration Parameters	4-7
4-2	Input Types and Calibration Values	4-12
4-3	List of Measured Variable Units	4-13
6-1	Power-Up Error Codes	6-4
6-2	On-Line Error Codes	6-5
8-1	Function Block by Type	8-1
FB28-1	Pulse Width and Maximum Rate	8-9
FB81-1	Process Ranges	8-10
FB81-2	MV Units	8-10
FB82-1	Input Types	8-11
FB82-2	Range Units	8-11
FB15-1	Status Conditions	8-41
FB98-1	Variable Code Choices	8-57
A-1	FIELDPAC Function Blocks	A-1

CHANGES FOR REVISION 4, OCTOBER 1998/OCTOBER 2000

Following is a partial list of the changes incorporated in this revision. Editorial changes not affecting technical content have also been made. Significant changes are marked by a change bar in the page outside margin, as shown here. Page dates were not changed for the October 2000 revision. Unless otherwise dated, changes are for the October 1998 version.

Cover	APACS logo and text removed. October 2000: banner changed to Siemens Moore.
Table of Contents	Updated to include added section, illustration, and revision information.
1.5 Product Support	October 2000: Text and contact information table updated.
2.4.3.1 Power Connections, Section C.	2-WIRE TRANSMITTER SUPPLY OUTPUT (Model 348E only), was changed to clarify the power up status of the terminals.
2.4.3.2 Signal Inputs and Outputs, Section D.	DIGITAL OUTPUTS, Figure 2-7 was changed to show the Transmitter Power Supply as 22 Vdc.

6.4.1 ERROR CODES, Table 6-1 Power Up Error Codes.	Error Codes E216 for FB81, E226 for FB82, and E236 for FB85/86/87 were added to the table.
6.5.7 DIRECT PRESSURE SENSOR INPUT	Installation instructions have been revised to clarify step 4 which is only needed for the Model 340 A/G Sensor.
8.5 PRESSURE SENSOR INPUT FB81	Output Identification 50 for Static Pressure and Output Identification 55 for Capsule Temperature were added to the function block.
8.18.5 INTEGRATOR/TOTALIZER FB16	Changed to show correct block diagram.
8.19.13 HART Interface FB98 - Table FB98-1	Variable Code Choices. Variable Code 9 for FB81 with Static Pressure and Variable Code 10 for FB81 with Capsule Temperature were added to the table.
9.16 FCO31	Single-Loop Controller (TSP) with Pressure Input - FCO31, Single-Loop Controller (TSP) with Pressure Input was added to the FCOs. This FCO covers a Single-Loop PID Controller with Tracking Setpoint and a Pressure Input.
UMA348-1-3	Removed since contents are included in the above sections.

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1.0 INTRODUCTION

This User's Manual for the Moore 348 Field Mounted Controller, or 'FIELDPAC' (FIELD Process Automation Controller), is divided into the following sections.

Introduction—Gives general information pertaining to product description, model designation, and specifications.

Installation—Provides general installation considerations, mounting and wiring guidelines, and specific mounting procedures.

Operation—Defines the controls, signal displays, and operating modes.

Calibration—Provides field calibration procedures for analog inputs and outputs.

Circuit Description—Supplies general circuit descriptions of the MPU Controller Board, the Keyboard/Display Assembly, and the optional Temperature Sensor and Pneumatic Input Boards.

Maintenance—Furnishes preventive maintenance guidelines, trouble-shooting, and subassembly replacement procedures.

Configuration—Provides detailed procedures to properly configure the controller by selecting a Factory Configured Option or from a "Design from Scratch" approach.

Function Block Descriptions—Provides a detailed description and specifications for each function block. Also provides function block connection details and listings of all configuration parameters.

Factory Configured Options—Is a listing of all available "Factory Configured Options" (FCO). These are contained in permanent memory and can be entered into configuration memory with just a few key strokes.

IMPORTANT

Save this User's Manual and make it available for installation, configuration, and maintenance of a Moore 348 Field Mounted Controller.

1.1 PRODUCT DESCRIPTION

The Model 348 Field Mounted Controller (i.e., FMC or FIELDPAC) is a microprocessor-based, self-contained, stand alone industrial operator station. Its components, the power supply, operator faceplate, analog and digital I/O, the optional direct process inputs, including the integral I/P and P/I transducers, are all mounted in a Type 4X (dust tight, waterproof, and corrosion resistant) enclosure. FIELDPAC design provides for user configuration of the desired station type and control strategy via software interconnection of function blocks.

FIELDPAC is available in two versions: the Model 348S (Intrinsically Safe design) and the Model 348E (Non-Incendive design). The Model 348E FIELDPAC is identical to the Model 348S except for the Transmitter Power

Supply, relay outputs in place of opto-transistors, and additional available options such as the Backlighted Display and AC Power Supply.
Figure 1-1 shows the FIELDPAC. The front panel contains all the control pushbuttons and signal displays required for local operation and configuration. Hardware and software for a standard or an enhanced FIELDPAC and the connectors for FIELDPAC options are located on the MPU Baseboard. All user electrical connections are made to terminals in the terminal compartment. Figure 1-2 shows a Model 348 with the process pressure input option.

FIELDPAC configuration is performed by the user and consists of interconnecting user selected function blocks (FBs) and entering the various required parameters to build the needed station configuration. A list of available function blocks is given in Appendix A. The station's configuration is stored in a nonvolatile memory to prevent loss of data should an electrical power interruption occur. Factory Configured Options (FCOs) are provided to simplify configuration.

All the necessary entry keys and alphanumeric displays for configuration are located on the faceplate of the FIELDPAC. Refer to the Model 348 Configuration Guide for details and procedures.

1.2 MODEL DESIGNATION

Each Model 348 FIELDPAC has a nameplate showing its model number and factory installed options. Use Table 1-1 to interpret the model number and the included options shown on the nameplate (located on left side of enclosure).

IMPORTANT

Before installing, applying power, or servicing, confirm the station’s model number by referring to the model designation on the nameplate and to Table 1-1.

1.3 SPECIFICATIONS

1.3.1 Mechanical

DIMENSIONS
FIELDPAC ..... See Figures 1-1 and 1-2

MOUNTING
Pipe Mounting ..... See Figure 2-1
Panel Mounting ..... See Figure 2-2
Wall Mounting ..... See Figure 2-3

NET WEIGHT
Model 348S_ ..... Consult Factory
Model 348E_ ..... Consult Factory

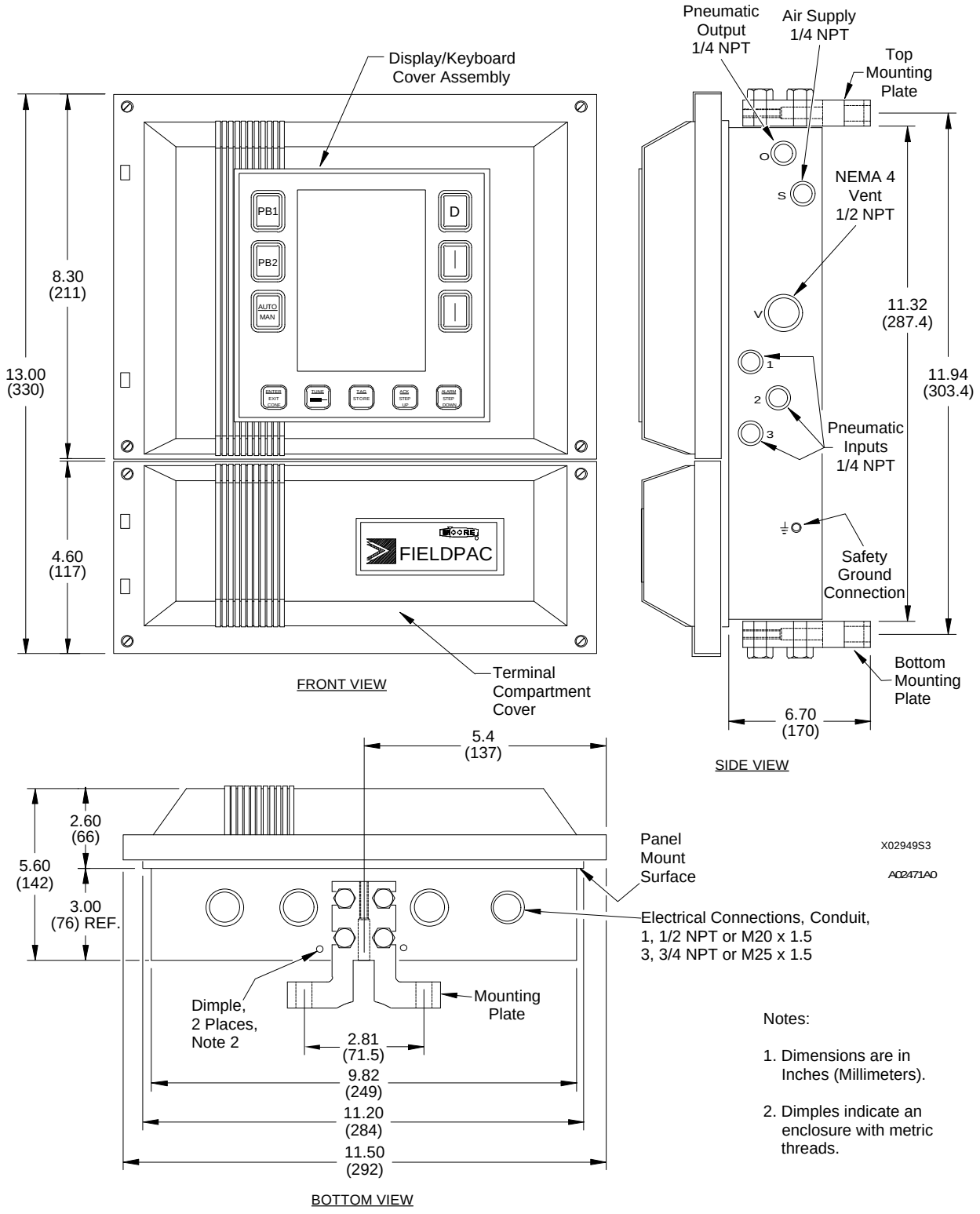


FIGURE 1-1 MODEL 348 FIELD MOUNTED CONTROLLER (FIELDPAC)

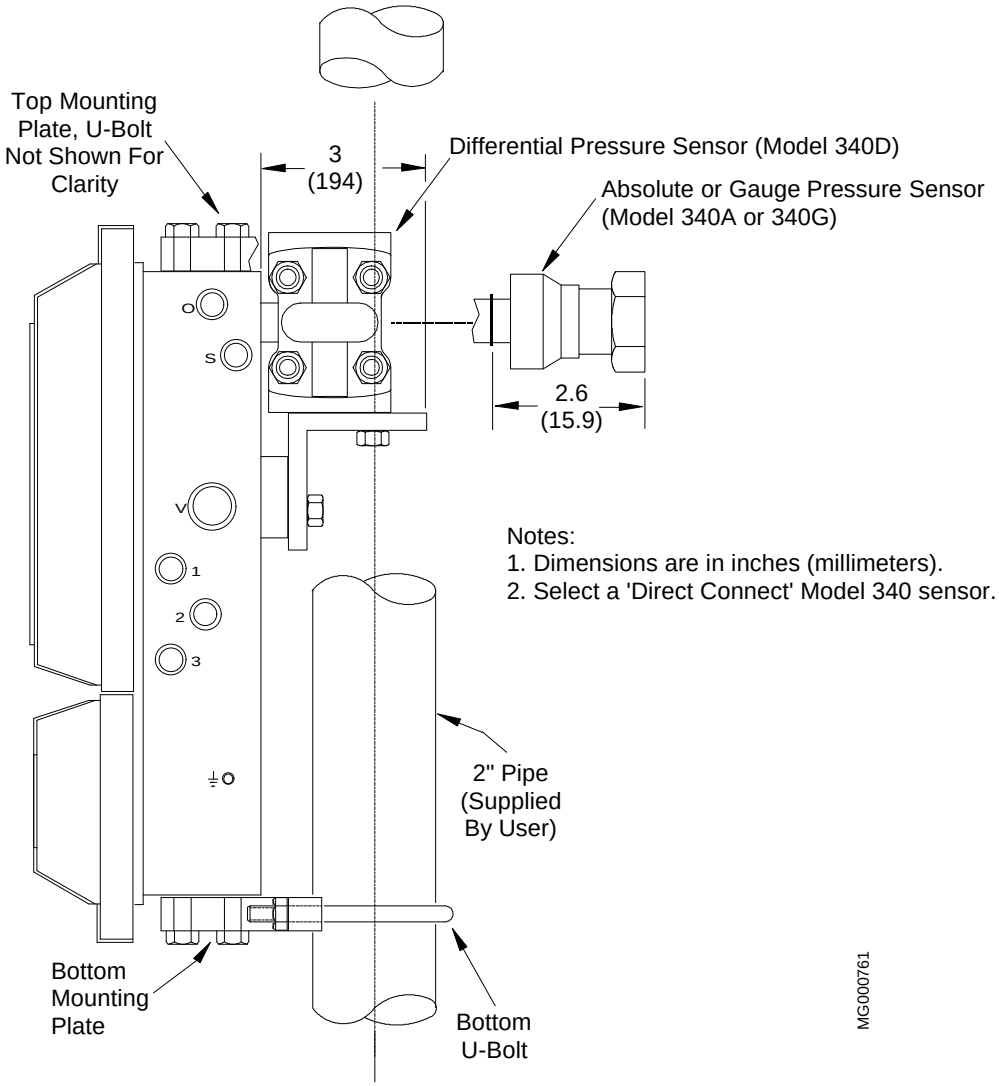


FIGURE 1-2 MODEL 348 DIMENSIONS, PROCESS PRESSURE INPUT MODELS

TABLE 1-1 Model Designation

Basic Model Number

348S Intrinsically Safe Field-Mounted Controller

348E Non-Incendive Field Mounted Controller

Power Supply

A 90-264 Vac, 47-63 Hz, Model 348E only

C 90-264 Vac, 47-63 Hz, Model 348E only (Use with CE or BASEEFA approval.)

D 14-28 Vdc, non-isolated

Operator's Display

1 Full-Function

2 Full-Function with Backlight, Model 348E only

Backplate Option

D Direct-Connected D/P Sensor

P Direct-Connected Gauge & Absolute Pressure Sensor

R Removable plug for future sensor mounting

N Not Required

Analog Option Board

A (1) 15 PSIG Pneumatic Input

C (3) 15 PSIG Pneumatic Inputs

D (1) 30 PSIG Pneumatic Input

F (3) 30 PSIG Pneumatic Inputs

T Thermocouple/RTD/Millivolt Input

N Not Required

Analog Output No.1 Options

1 4-20 mA Current

2 15 PSIG Pneumatic

3 30 PSIG Pneumatic

Design Level

B Current Design

Reserved

N Not Required

X Special Modification

Reserved

N Not Required

Communications

H HART ®

Electrical Connections

1 NPT

2 Metric

Hazardous Area Classification (See Note)

N Non-Approved

4 FM/CSA Div. 2, Class I, Groups A, B, C, D suitable for non-incendive

Y CSA Intrinsically Safe Div. 1, Class I, Groups C & D, Class II, Groups E, F, & G, Class III

E CE Compliant

L BASEEFA Ex N IIC (Includes CE)

348	E	D	1	D	N	2	A	N	N	H	1	N

Sample Model Number

NOTE

Other hazardous area certifications pending. Contact your local Moore representative or the factory for latest certifications.

1.3.2 Electrical

1.3.2.1 Power Requirements

AC POWER (Model 348EA)
- Nominal Voltage and Frequency .. 115 or 230 Vac, 50/60 Hz
- Voltage and Frequency Limits ..... 90 to 264 Vac, 47 to 63 Hz
- Power Consumption ..... 32 VA maximum
- Voltage Selection ..... Universal (Auto-sensing, no setting required)
- AC Power Terminals ..... L1 (H) - Terminal 'B1'
  L2 (N) - Terminal 'A2'
  G (Gnd) - Terminal 'B3'

DC POWER (Model 348_D)
- Nominal Voltage ..... Vps = 24 Vdc
- Voltage Limits ..... Vps = 14.0 to 28.0 Vdc
- Power Consumption ..... 4.5 Watts maximum
- DC Power Terminals ..... DC Power (+) - Terminal 'F1'
  DC Power (-) - Terminal 'F2' (Gnd)

1.3.2.2 2-Wire Transmitter Supply Power (Model 348E only)

Nominal Output Voltage ..... +22 Vdc
Output Voltage (Model 348_D) ..... +(Vps-4.5) Vdc
Current ..... 80 mA (max.) at 22 Vdc (short-circuit protected)
XMTR Supply 1 ..... Terminal 'F6'
XMTR Supply 2 ..... Terminal 'F9'
XMTR Supply 3 ..... Terminal 'F12'
(all terminals internally connected to the same current-limited power supply)

1.3.3 Input/Output Ports

ANALOG INPUTS
- Input Channels 3
- Input Range ..... 0 to 5 Vdc
- Standard Calibration ..... 1 to 5 Vdc
- Zero Adjustment ..... 0 to 1 Vdc
- Span Adjustment ..... 4 to 5 Vdc
- Input Type ..... Single-ended (non-isolated)
- Input Impedance ..... > 1 Megohm
- Normal Mode Rejection ..... 3 dB typical @ 1.4 Hz, 64 dB typical @ 60 Hz ±3 Hz (2-pole filter with breakpoint frequency @ 2 Hz)
- Digital Filter Range ..... 0.001 to 10 Hz (breakpoint frequency)
- Calibration Accuracy ..... < ±0.1% of span
- A/D Resolution ..... 12 bits
- A/D Linearity ..... ±1 LSB

Maximum Continuous Input ..... ±30 Vdc
Ambient Temperature Effect ..... < ±0.85% of span for a 50°C ambient temperature change (typical: ±0.5%)

DIGITAL INPUTS
- Input Channels 2
- Input Type ..... Opto-coupler (isolated)
- Input Impedance ..... 3300 Ohms
- Logic "1" Range ..... 12 to 30 Vdc
- Logic "0" Range ..... 0 to 5 Vdc
- Isolation ..... 250 Vrms
- Minimum "On Time" ..... 150 msec
- Minimum "Off Time" ..... 150 msec

PNEUMATIC INPUTS (Models 348____A, -C, -D, -F)
- Input Channels ..... 1 or 3
- 15 psig Sensor (Models 348____A, -C)
  - Standard Calibration ..... 3 to 15 psig
  - Zero Adjustment ..... 0 to 4 psig
  - Full Scale Adjustment ..... 12 to 15 psig
- 30 psig Sensor (Models 348____D, -F)
  - Standard Calibration ..... 3 to 27 psig
  - Zero Adjustment ..... 0 to 8 psig
  - Full Scale Adjustment ..... 24 to 30 psig
- Accuracy ..... ±0.35% of span
- Temperature Effect ..... Ambient: ±0.15% of span per °C
  Calibrated: ±0.85% of full span

MILLIVOLT INPUT (Model 348____T)
- Input Channels 1
- Input Impedance ..... > 1.0 Megohm
- Wide Range
  - Range Limits ..... -15 to +100 mVdc
  - Zero ..... -15 to +100 mVdc
  - Span ..... 5 to 115 mVdc
- Narrow Range
  - Range Limits ..... -10 to +25 mVdc
  - Zero ..... -10 to +25 mVdc
  - Span ..... 1 to 35 mVdc

RTD INPUT (Model 348____T)

- Input Channels 1
- Platinum RTD Type ..... 2, 3, or 4 wire
- Input Impedance ..... > 1.0 Megohm
- RTD Types ..... 100 Ohm, 200 Ohm, 500 Ohm
- DIN ..... =0.003850 / /°C
- US ..... =0.003902 / /°C
- Accuracy ..... <+/- 0.25°C
- Resolution ..... <0.10°C
- Ambient Temperature Effect ..... <+/- 0.04°C/°C

THERMOCOUPLE INPUT (Model 348____T)

- Input Channels 1
- Input Impedance ..... 1.0 Megohm
- Reference Junction Compensation ... Automatic
- Thermocouple Burnout Direction …. Selectable - UP or DOWN
- Conformity ..... <= 0.06°C; NIST curve based on IPTS - 1968
- Thermocouple Types ..... B, E, J, K, N, R , S, T
- Temperature Range …… Zero and Span configurable
- Accuracy ..... <+/- 0.75°C
- Ambient Temperature Effect ..... <+/- 0.06°C/°C

PROCESS PRESSURE INPUT (Model 348___D)

- Input Channels 1
- Sensor Type ..... Absolute, Gauge, or Differential
- Connection Type ..... Direct or Remote
- Accuracy ..... < ±0.05% (Upper Range Limit)
- Ambient Temperature Effect …….. < ±0.5% of span for a 50°C ambient temperature change (typical: ±0.3%)

ANALOG OUTPUTS

- Output Channels 2
- Standard Calibration ..... 4 to 20 mAdc
  - Zero ..... 4 mAdc ± trim
  - Span ..... 16 mAdc ± trim
- Signal Reference ..... Negative (-) output terminal is station common
- Accuracy ..... < ±0.1% of span
- Current Limit ..... > 21.6 mA
- Output Load ..... 0 to L_m Ohms
  DC Powered: Lm=[Vsupply - 6.83V]/21.6 mA
  AC Powered: Lm=800 Ohms
- Ambient Temperature Effect ….. < ±0.5% of span for a 50°C ambient temperature change

DIGITAL OUTPUTS
- Output Channels 2
- Output Type ..... Open Collector Transistor (emitter tied to station common)
- Load Voltage ..... 30 Vdc maximum
- Load Current ..... 150 mA maximum
- Transistor "ON" Voltage ..... 0.9V max. @ 100 mA load
- Transistor "OFF" Leakage ..... 0.5 uA max. @ 30 Vdc

RELAY OUTPUTS (Model 348E)
- Output Channels 2
- Relay Type ..... Epoxy Sealed
- Contact Configuration ..... SPDT (Form C)
- Contact Rating ..... 3A at 250 Vac

ISOLATED DIGITAL OUTPUTS (Model 348S)
- Output Channels 2
- Output Type ..... Opto-Transistor
- Load Voltage ..... 30 Vdc maximum
- Load Current ..... 2 mA minimum @ 10 Vdc
- Transistor "ON" Voltage ..... 10 V max. @ 2 mA load
- Transistor "OFF" Leakage ..... 50.0 nA max. @ 10 Vdc
- Isolation Voltage ..... 250 Vrms

PULSE INTEGRATOR OUTPUT
- Output Channels 1
- Output Type ..... Open Collector Transistor (emitter tied to station common)
- Load Voltage ..... 30 Vdc maximum
- Load Current ..... 150 mA maximum
- Transistor "ON" Voltage ..... 0.9V max. @ 100 mA load
- Transistor "OFF" Leakage ..... 0.5 uA max. @ 30 Vdc
- Maximum Frequency ..... Configurable in FB28

PNEUMATIC OUTPUT OPTION
- Output Channels 1
- 15 PSIG
  - Standard Calibration ..... 3 to 15 psig
  - Supply Pressure ..... 20 psig, 18 psig minimum
- 30 PSIG
  - Standard Calibration..... 3 to 27 psig
  - Supply Pressure ..... 35 psig, 33 psig minimum
- Accuracy ..... ±0.35% of span
- Repeatability ..... 0.05% of span
- Deadband ..... 0.05% of span
- Ambient Temperature Effect ..... ±0.05% per °F
- Air Consumption ..... 0.1 SCFM
- Supply Capacity ..... 2.5 SCFM maximum at 20 psig
- Exhaust Capacity ..... 2.5 SCFM

Maximum Supply Pressure ..... 45 PSI

HART COMMUNICATIONS
- Type ..... HART Slave
- Coupling ..... AC (on +side only, -side tied to Signal Common)
- Physical Layer ..... HART Rev. 7.0
- Commands ..... HART Rev. 5 or 6

1.3.4 Environmental

Operating Temperature Limits ..... -40°C to +85°C (-40°F to +185°F)
Operating Humidity ..... IEC 654-1 Class D_2 (5 to 100%)
Transportation and Storage
- Temperature Limits ..... -40°C to +85°C (-40°F to +185°F)
- Humidity Limits ..... 0 to 100% RH, Non-Condensing

ESD Susceptibility .....15 kV to case
5 kV to any terminal connection
Surge Protection ..... User Terminals: 1.5 kV per ANSI/IEEE C37.90
Corrosion Protection ..... G3 per ISA S71.04-85
Coating ..... PC boards are conformally coated

Isolation
- Primary to Secondary ..... 250 Vac
- Terminal to Ground ..... 250 Vac per BS6941:1988

Heat Dissipation
- AC Powered ..... 65 Btu/Hr
- DC Powered ..... 16 Btu/Hr

Enclosure ..... TYPE 4X

1.3.5 Hazardous Area Classification

Before installing, applying power to, or servicing a station, see the station's nameplate and Table 1-1 for electrical classification. Other certifications are pending. Contact Moore for the latest approvals and certifications.

Model 348S

CSA ..... Class I, Division 1, Groups C & D
Class II, Division 1, Groups E, F & G
Class III, Division 1
Type 4X

Model 348E

FM/CSA ..... Class I, Division 2, Groups A, B, C & D

CE ..... EMC Compliant: EN50081-2 Emissions
EN50082-1 Immunity
EN50082-2 Immunity

1.3.5.1 FM/CSA Hazardous Location Precautions

This section provides FM/CSA hazardous location precautions that should be observed by the user when installing or servicing the equipment described in this Manual. These statements supplement those given in the preceding section.

WARNING

Failure to observe the following precautions could result in an explosion hazard.

Precautions - English

For Class I, Division 1, and Class II, Division 2 hazardous locations,

Use only factory-authorized replacement parts. Substitution of components can impair the suitability of this equipment for hazardous locations.

For Division 2 hazardous locations:

When the equipment described in this Manual is installed without safety barriers, the following precautions should be observed. Switch off electrical power at its source (in non-hazardous location) before connecting or disconnecting power, signal, or other wiring.

Précautions - Français

Emplacements dangereux de classe I, division 1 et classe I, division 2:

- Les pièces de rechange doivent être autorisées par l'usine. Les substitions peuvent rendre cet appareil impropre à l'utilisation dans les emplacements dangereux.

Emplacement dangereux de division 2:

Lorsque l'appareil décrit dans la notice ci-jointe est installé sans barrières de sécurité, on doit couper l'alimentation électrique a la source (hors de l'emplacement dangereux) avant d'effectuer les opérations suivantes branchment ou débranchement d'un circuit de puissance, de signalisation ou autre.

1.3.5.2 CE (EMC) Compliant Considerations

A Declaration of Conformity in accordance with EN 45014 has been issued for Model 348 for compliance with the European Union's EMC directive. Testing was done in accordance with the following:

The European Union's EMC Directive
EN50081-2: 1993 Generic Industrial Emissions
EN50082-1: 1992 Generic Light Industry Immunity
EN50082-2: 1995 Generic Industrial Immunity

Special Conditions*

Compliant stations will contain an 'E' in the Electrical Classification portion of the model designation.

FM/CSA electrical classification approval as non-incendive for Division 2 service applies to installations in North America and where recognized. Check local approval requirements.

A Declaration of Conformance appears later in this section.

Environmental Conditions, Per IEC 664:

Installation Category II

Pollution Degree 2

Use of the equipment in a manner not specified by the manufacturer may impair the protection provided by the equipment.

Route electrical power to the station through a clearly labeled circuit breaker or on-off switch that is located near the station and accessible by the operator. The breaker or switch should be located in a non-explosive atmosphere unless suitable for use in an explosive atmosphere.

Local Instrument Link twinaxial cable must be shielded.

All signal cables, including HART communications, use shielded cable. The case is connected to earth ground.

A sample Model 348 was tested and found to have a 3.6°C temperature shift between 95 and 100 MHz radiated immunity disturbance, as much as a 2.5°C temperature shift at 110 MHz, 191 MHz, 195 MHz, and between 315 and 400 MHz, and a 2.5°C temperature shift for 417 to 500 MHz disturbances for a T-type thermocouple. The same sample had narrow ohm RTD deviations of -0.5 Ω at a 116.5 MHz disturbance, -2.8 Ω shift at 340.7 MHz and 450.0 MHz, a -1.0 Ω deviation at 345.7, 409.0 MHz and 461.0 MHz, a -7.7 Ω deviation at 420 MHz, and -6.9 Ω at 428.0 MHz.

1.3.5.3 BASEEFA Ex N IIC T5 Considerations

This section provides BASEEFA hazardous location precautions that should be observed by the user when installing or servicing the equipment described in this manual. These statements supplement those given in the preceding section(s).

The Model 348ExxxxxxxxxxL complies with the requirements of BS6941: 1988. The apparatus is certified for Ex N IIC T5 (Tamb = -40ºC to +60ºC). For a copy of the certificate of assurance, contact Moore Products Co. at 215-646-7400 ext. 4TIC.

Special Conditions
Install the controller such that the main enclosure cover is exposed to no greater than a low risk of mechanical damage.
Protect the controller's 90-264 Vac power supply with a 1A, 250V, HBC fuse.
Supply the controller's pneumatic system with clean, dry air.

1.3.6 Two-Wire Cable for HART Communication

Type..... Twisted Single-Pair, Shielded, Copper

Conductor Size for Network Length
- Less than 500 ft. (1524m)..... 24 AWG minimum
- More than 500 ft. (1524m) ..... 20 AWG minimum, 16 AWG maximum

Cable Capacitance..... Refer to Appendix C

Recommendation ..... Beldon 8641, 24 AWG
Beldon 8762, 20 AWG

Length Maximum ..... Refer to Appendix C

DECLARATION OF CONFORMITY

according to EN 45014

Moore Products Co.
Sumneytown Pike
Spring House, PA 19477

declares under its sole responsibility that the product:

Model 348xxxxxxxxxxE Field Mounted Controller,

to which this declaration relates is in conformity with the following standards or other normative documents listed below,

EN 61010-1, with amendments 1 and 2, Safety Requirements for electrical equipment for measurement, control and laboratory use
EN 50081-2, Electromagnetic compatibility: Generic emission standard Industrial environment
EN 50082-1, Electromagnetic compatibility: Generic immunity standard, Residential, commercial, and light industrial environment
EN 50082-2, Electromagnetic compatibility: Generic immunity standard Industrial environment

following the provisions of the:
Low Voltage Directive 73/23/EEC as amended by 93/68/EEC
EMC Directive 89/336/EEC as amended by 91/263/EEC, 92/31/EEC and 93/68/EEC

Manufactured in Spring House, PA, U. S. A.

Dated: 12/31/96

Peter F. Schiano
Director of Operations
Measurement and Control Division

1.4 ACCESSORIES

Table 1-2 lists some accessories that are available for use with the Model 348 Field Mounted Controller.

TABLE 1-2 Accessories for the FIELDPAC

PART NUMBER	PRODUCT	DESCRIPTION
15939-48VN.NN	Configuration Software	IBM® personal computer based software for configuring FIELDPAC direct through a modem or through a Model 320 ICI and a Model 385 LOS.
- - - -	Permanent Instrument Tag	The instrument nameplate can be stamped with up to three lines of text (at up to 30 characters/line)
16161-88	Extended Mounting Plate (2 Required)	Provides additional room for mounting. Required when wall mounting a FIELDPAC with a 3-valve manifold and a D/P sensor. Do not use in area with excessive vibration.
16055-312	HART® Modem	A Bell 202T style modem for use with the above PC-based configuration software package.
- - - -	Test and Inspection Certificate	A certified test and inspection report on the analog I/O performance of an individual unit.
14999-116	Test Fitting	Use for in-service measurement of current signals. It is weatherproof, includes 18" of lead wire, and has 1/2 NPT threads for mounting in a conduit tee or elbow.
16161-140	Stahl 9381/10-158-160-10 24 Vac/dc Barrier Supply Kit	This approved barrier/supply combination powers the Model 348S when installed in Class I, Div. 1, Groups C & D, Class II, Groups E, F & G, and Class III areas.
16161-141	Stahl 9381/10-158-160-50 120/240 Vac/dc Barrier Supply Kit	This approved barrier/supply combination powers the Model 348 S when installed in Class I, Div. 1, Groups C & D, Class II, Groups E, F & G, and Class III areas.
16161-142	Stahl 9001/02-016-015-10 HART Signal Barrier Kit	This approved barrier conditions HART signals passing to the Model 348 S when installed in Class I, Div. 1, Groups C & D, Class II, Groups E, F & G, and Class III areas.

1.5 PRODUCT SUPPORT

Product support can be obtained from a Technical Information Center (TIC). Each regional TIC is a customer service center that provides direct telephone support on technical issues related to the functionality, application, and integration of all products supplied by Siemens Moore. Regional TIC contact information is provided in Table 1.1. Your regional TIC is the first place you should call when seeking product support information. When calling, it is helpful to have the following information ready:

- Caller ID number, or name and company name—When someone calls for support for the first time, a personal caller number is assigned. Having the number available when calling for support will allow the TIC representative taking the call to use the central customer database to quickly identify the caller's location and past support needs.

- Product part number or model number and version

- If there is a problem with product operation:
  - Whether or not the problem is intermittent
  - The steps performed before the problem occurred
  - Any error messages or LED indications displayed
  - Installation environment

Customers that have a service agreement (ServiceSuite or Field Service Agreement) are granted access to the secure area of our Web site (www.smpa.siemens.com). This area contains a variety of product support information. To log on, you will be prompted to enter your username and password.

TABLE 1-3 TIC Contact Information

TIC NORTH AMERICA	Tel:	+1 215 646 7400, extension 4993
	Fax:	+1 215 283 6358
	E-mail:	MandCTechSupp@moore-solutions.com
	Hours of Operation:	8 a.m. to 6 p.m. eastern time Monday – Friday (except holidays)
	Secure Web Site:	www.smpa.siemens.com
	Repair Service	+1 215 646 7400 extension 4993

TIC ASIA	Tel:	+65 299 6051
	Fax:	+65 299 6053
	E-mail:	TICGroupAP@moore-solutions.com
	Hours of Operation:	9 a.m. to 6 p.m. Singapore time Monday – Friday (except holidays)
	Secure Web Site:	www.smpa.siemens.com/techservices
	Repair Service:	+011 65 299 6051

TIC EUROPE	Tel:	+44 1935 470172
	Fax:	+44 1935 706969
	E-mail:	TICGroupEurope@moore-solutions.com
	Hours of Operation:	8:30 a.m. to 5:15 p.m. GMT/BST Monday – Thursday(except holidays) 8:30 a.m. to 4:00 p.m. GMT/BST Friday (except holidays)
	Public Web Site:	www.smpa.siemens.com
	Repair Service	+44 1935 470172

■

2.0 INSTALLATION

This section provides general information such as installation considerations and mounting and wiring guidelines for the Moore FIELDPAC Field Mounted Controller. Detailed information on the mounting and the electrical and pneumatic connections of the FIELDPAC is also provided in this section.

2.1 INSTALLATION CONSIDERATIONS

The FIELDPAC is intended for two-inch pipe mounting. It can be installed in an outdoor location, mounted either in a panel cutout, on a two inch pipe, or on a wall. Pipe mounting details are shown in Figure 2-1, panel cutout dimensions are given in Figure 2-2, and a typical wall mounting arrangement is depicted in Figure 2-3.

The FIELDPAC can be mounted in any position, with the front panel in a vertical or slanted position. Although direct sunlight does not harm the FIELDPAC, it may make the display difficult to read. For this reason, an attempt should be made to mount the FIELDPAC so that direct sunlight does not strike the display.

A FIELDPAC is usually shipped with all the circuit boards installed in the case.

2.2 ENVIRONMENTAL CONSIDERATIONS

See “Specification” section for FIELDPAC operating temperature limits and operating humidity and maximum moisture content. The air surrounding any operating FIELDPAC must be kept below 85°C (185°F). The temperature of the air should be checked to ensure that this specification is not being exceeded.

CAUTION

Exceeding specified operating temperature limits can adversely affect performance and may cause damage.

Forced air ventilation may be required when FIELDPACs are mounted in a partially or completely enclosed panel or cabinet. When clean air is present, exhaust fans are often mounted across the top of a panel and louvers formed in the panel bottom. Air is drawn upward between the station cases. When air contains particulate matter, fans and filters are often located at the panel bottom and louvers at the top. Filtered air is now forced upward between the station cases. Filters must be serviced periodically.

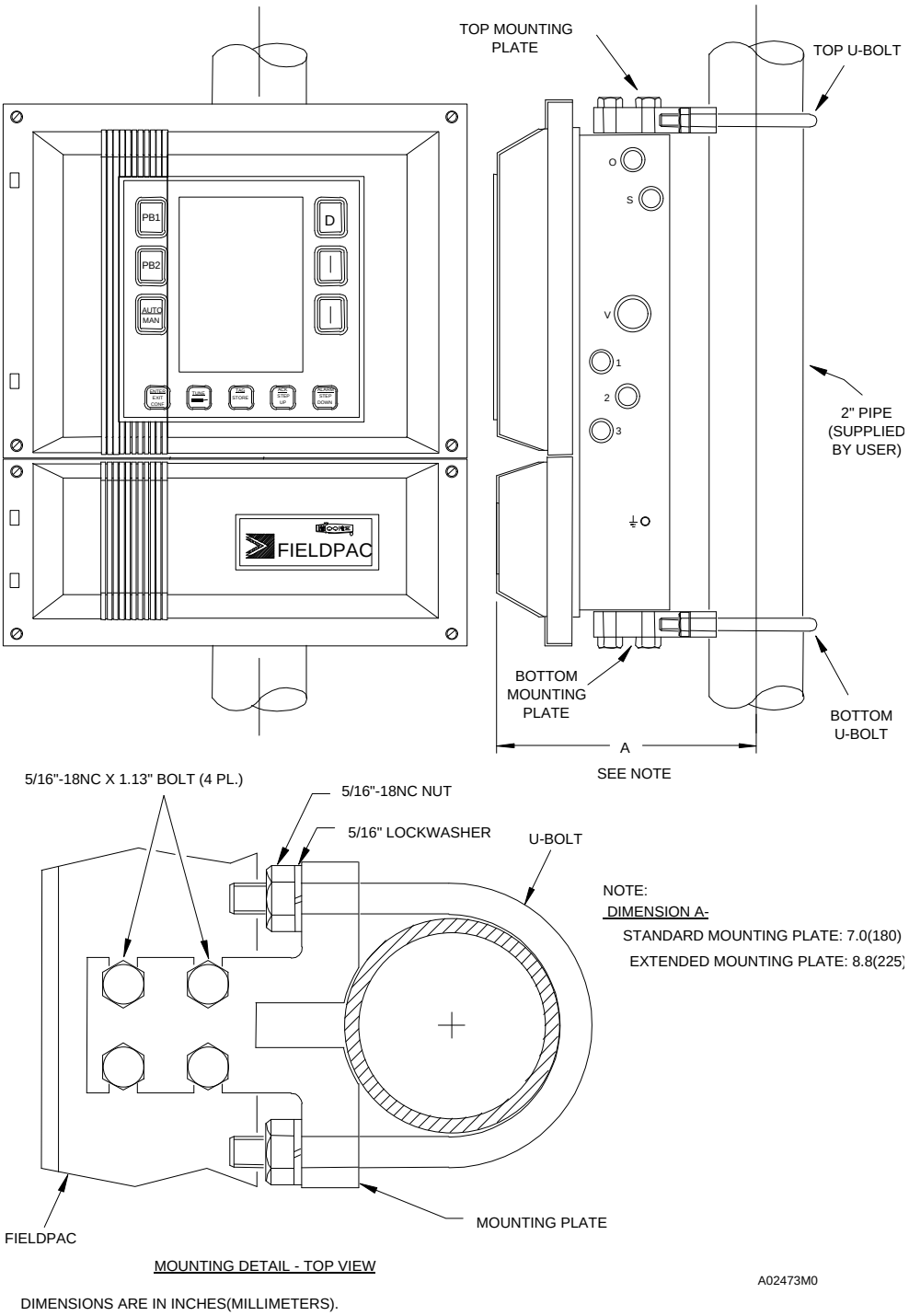
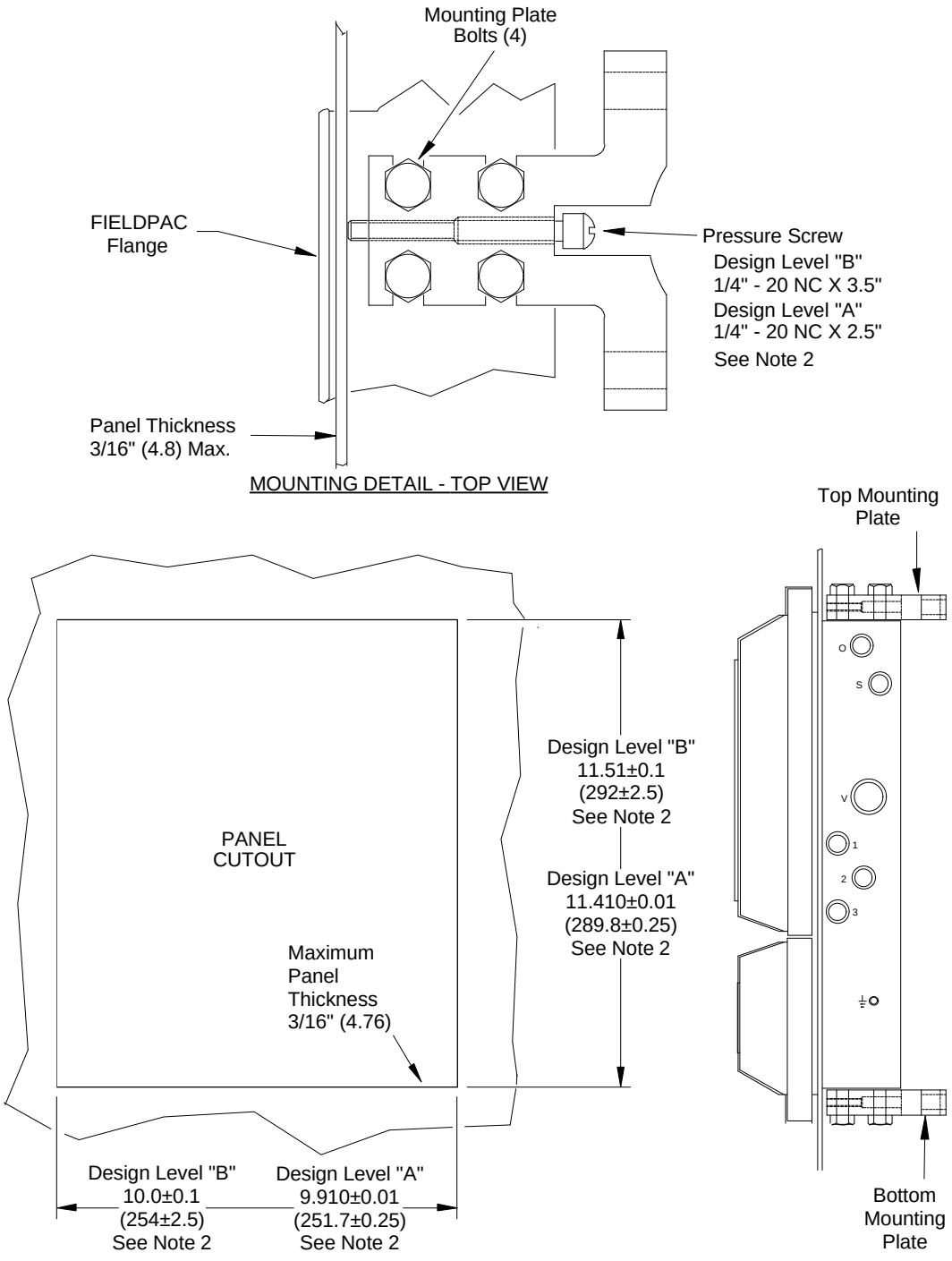


FIGURE 2-1 Pipe Mounting Details



Notes:
1. Dimensions are in Inches (Millimeters).
2. Design Level is designated by 10th character in model number. See Controller nameplate.

FIGURE 2-2 Panel Mounting Dimensions

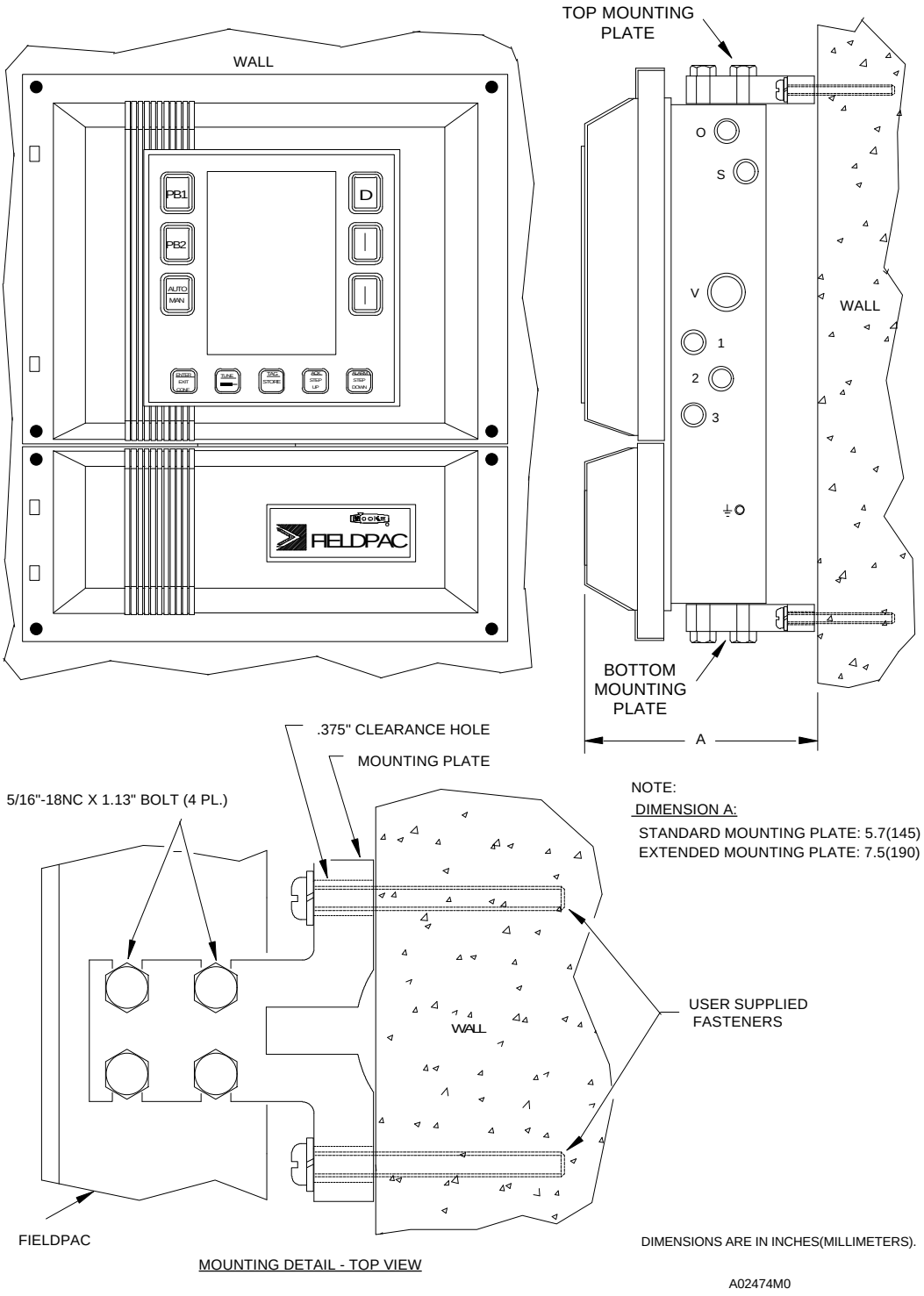


FIGURE 2-3 Typical Wall Mounting

Only high quality, quiet running fans should be used. Also, the fans should not generate electrical noise which could interfere with electronic instruments.

A sealed cabinet (e.g., NEMA12) containing equipment that does not generate significant heat should contain a recirculating fan for forcing air flow around equipment and throughout the cabinet preventing hot spots from developing.

Forced air conditioning may be needed in panels and cabinets with high equipment density or significant heat generating capability. Periodically change or clean air filters.

Industrial environments often contain particulate, liquid, and gaseous contaminants. Particulate matter, usually dust and dirt, is abrasive and can cause intermittent connections. A layer of dust on circuit boards can inter-fere with semiconductor heat dissipation. Liquid and gaseous contaminants can have a corrosive effect on metal, rubber, plastic and circuit board components. Extended exposure to these contaminants may result in malfunctions.

To reduce contaminant related equipment malfunctions:

1. Identify contaminants and implement methods to reduce their presence.

2. When cleaning equipment and surrounding area, especially the floor, either vacuum away all dust and dirt or use a dampened rag or mop. Sweeping or dry dusting recirculates dust and dirt.

3. Clean or replace all air conditioning filters, room air filters, and equipment filters regularly.

4. Inform all personnel with access to the equipment of the need for cleanliness.

2.3 MECHANICAL INSTALLATION

The following sections provide guidelines and procedures for mounting FIELDPACs in a panel, on two inch pipes, and on wall surfaces. Each installation should be structurally rigid and free of vibration.

2.3.1 Panel Mounting

The panel face should provide a flat, rigid mounting surface. Stiffeners should be welded to the back of the panel if there is a possibility that the panel face will bow. Figure 2-2 shows the needed cutout dimensions. The panel cutout should be square and level, especially the bottom edge. Uneven cutting of the bottom edge can cause the station case(s) to tilt and detract from front panel appearance.

Any nearby raceways, conduit, and wiring should not interfere with removing or accessing a FIELDPAC and other associated instruments, control devices, alarms, and related equipment.

Refer to Figure 2-2, Panel Mounting, while proceeding with the following steps.

1. Loosen and remove the top and bottom mounting plates from the FIELDPAC.

2. Insert FIELDPAC into panel cutout.

3. Install and tighten (4 bolts each) the top and bottom mounting plates to the FIELDPAC.

4. Square FIELDPAC with panel.

Alternately tighten the top and bottom pressure screws in the mounting plates until FIELDPAC is secured to panel. Do not over tighten.

2.3.2 Pipe Mounting

The vertical two inch pipe should provide a rigid mounting structure. Figure 2-1 shows the mounting details. Any nearby raceways, conduit, and wiring should not interfere with the mounting and accessibility of the FIELDPAC and other associated instruments, control devices, alarms, and related equipment.

A FIELDPAC equipped with a three-valve manifold and a D/P sensor must use the Extended Mounting Plate kit (see “Accessories” section). Use of the Extended Mounting Plate kit is not recommended in an area with excessive vibration.

Refer to Figure 2-1, Pipe Mounting, while proceeding with the following steps.

1. Install the top and bottom mounting plates (4 bolts supplied with each unit) to the FIELDPAC cabinet. Leave the U-bolts off the mounting plates.

2. Position the FIELDPAC against the pipe at the required height.

3. Insert a U-bolt around the pipe and into the top mounting plate.

4. Secure the U-bolt with two 5/16" lockwashers and two 5/16"-18 nuts. Do not over tighten.

5. Repeat steps 3 and 4 for the bottom mounting plate.

2.3.3 Wall Mounting

The wall should provide a flat, rigid mounting surface. Stiffeners should be added to the back of the wall if there is a possibility that the wall panel is not strong enough to support the FIELDPAC. Figure 2-3 shows a typical wall installation. Any nearby raceways, conduit, and wiring should not interfere with the installation and accessibility of the FIELDPAC and other associated instruments, control devices, alarms, and related equipment.

A FIELDPAC equipped with a direct-connected D/P sensor must use the Extended Mounting Plate kit (see “Accessories” section). Use of the Extended Mounting Plate kit is not recommended in an area with excessive vibration.

Refer to Figure 2-3, Wall Mounting, while proceeding with the following steps.

1. Install the top and bottom mounting plates (4 bolts supplied with each unit) to the FIELDPAC cabinet. Leave the U-bolts off the mounting plates.

2. Position the FIELDPAC against the wall at the required height and mark the four holes that will be needed for mounting.

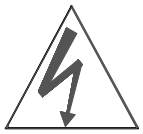
3. Determine what type of fastener is most appropriate for the given wall and the 0.375" clearance holes in the mounting plates.

4. Prepare the wall to accept the selected fasteners provided by user.

5. Position the FIELDPAC against the wall over the four prepared holes and secure it with the selected fasteners.

2.4 ELECTRICAL INSTALLATION

The following sections describe wiring guidelines that should be followed when wiring a FIELDPAC installation and define the purpose of each terminal.



WARNING

Remove power from all involved wires and terminals to eliminate electrical shock hazard.

2.4.1 Conduit Installation

Consider the following guidelines for conduit installation:

- The Model 348 enclosure is provided with four conduit ports that will accept one ½"-14 NPT and three 3/4"-14 NPT or one M20 x 1.5 and three M25 x 1.5 conduit fittings.

- Field wiring should be installed in conduit.

- When routing conduit, avoid areas that might subject the conduit to chemical or physical abuse or areas with high EMI/RFI conditions.

- Be sure the conduit and its contained cable are not exposed to temperatures exceeding the cable's normal operating temperature range.

- In a high humidity environment, with the FIELDPAC mounted at a low point in the conduit run, use a drain seal at the conduit entrance to prevent condensation from entering the FIELDPAC enclosure.

- Remove all sharp edges and burrs from conduit that may damage wires.

2.4.2 Wiring Guidelines

All wiring must conform to the National Electrical Code and local codes. DC wiring should be separated from AC wiring, as much as possible, and away from AC powered pushbuttons, alarms, annunciators, motors, solenoids, and similar devices. Metallic and non-metallic raceway and conduit are commonly used for routing panel wiring. Wiring not installed in raceways or conduit should be clamped or supported approximately every 12 inches (300 mm).

Stranded wire is recommended. Carefully select the wire size, conductor material, and appropriate insulation. Some selection considerations are:

- Current and voltage to be carried
- Total length of each wire run
- Whether wire will be bundled or run singly
- Indoor or outdoor installation
- Temperature extremes
- Exposure to sunlight
- Vibration
- Types of contaminants

Electrical connections are made to terminal blocks in the terminal compartment of the FIELDPAC. To make a connection, insert a stripped wire end into the wire hole of the terminal block and tighten the pressure screw. When preparing wires and making connections, refer to Figure 2-4 and the following:

- Stranded Conductor: Strip wire end 3/8" (9 mm) to 7/16"(11 mm).
- Solid Conductor: Strip wire 3/8" (9 mm) to 7/16"(11 mm).
- Do not nick the conductor or cut away conductor strands when stripping insulation.

1. Carefully inspect each connection for mechanical strength and stray strands of wire that could short to an adjacent terminal; conductor should not be visible outside the terminal block body.

2. Insert the stripped wire end into the side wire hole and under the pressure plate and tighten the top terminal screw for a reliable electrical connection. Insulation should butt against the pressure plate and the conductor should not be visible outside the terminal block body.

3. Inspect each completed connection for strands of wire that could short to an adjacent terminal, for connection to the correct terminal, and for tightness of the terminal screw.

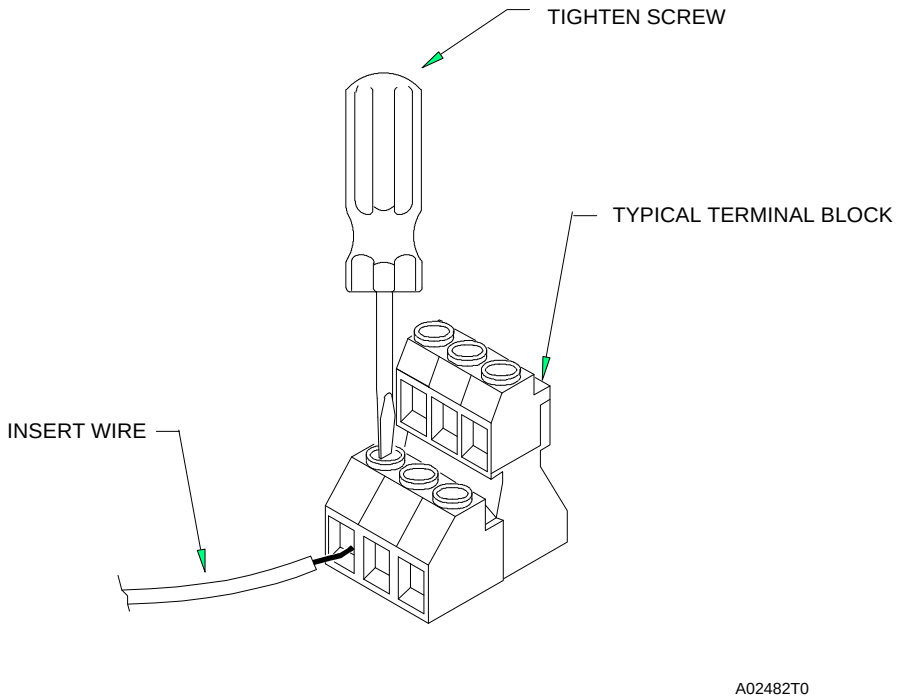


FIGURE 2-4 Conductor Connection to Terminal Block

2.4.3 Terminal Connections

All electrical connections are made to the terminals located at the front of the FIELDPAC case behind the terminal access cover. The terminals are designated by a terminal block letter and a row number (e.g., A1, E8) as shown in Figure 2-5. Recommended wire size for signal wiring is 18 gauge (AWG); power wiring, 14 gauge (AWG).

WARNING

Remove power from all involved wires and terminals to eliminate electrical shock hazard.

The terminal blocks accept stranded or solid wires. See Figure 2-4. For an electrical connection to be made, a terminal screw must be tightened, clamping the wire between the pressure plate and base plate inside the terminal block body to insure a good electrical contact.

SIGNAL COMMON is at terminal **'F2'** (DC Power -). It should be connected to the user's instrument bus common. Within the FIELDPAC, station common is connected to:

- A common reference point which in turn is connected to the XMTR power supply common
- Digital output common (except the 2 opto-transistors in Model 348S)
- All analog input and analog output commons
- HART communications port common

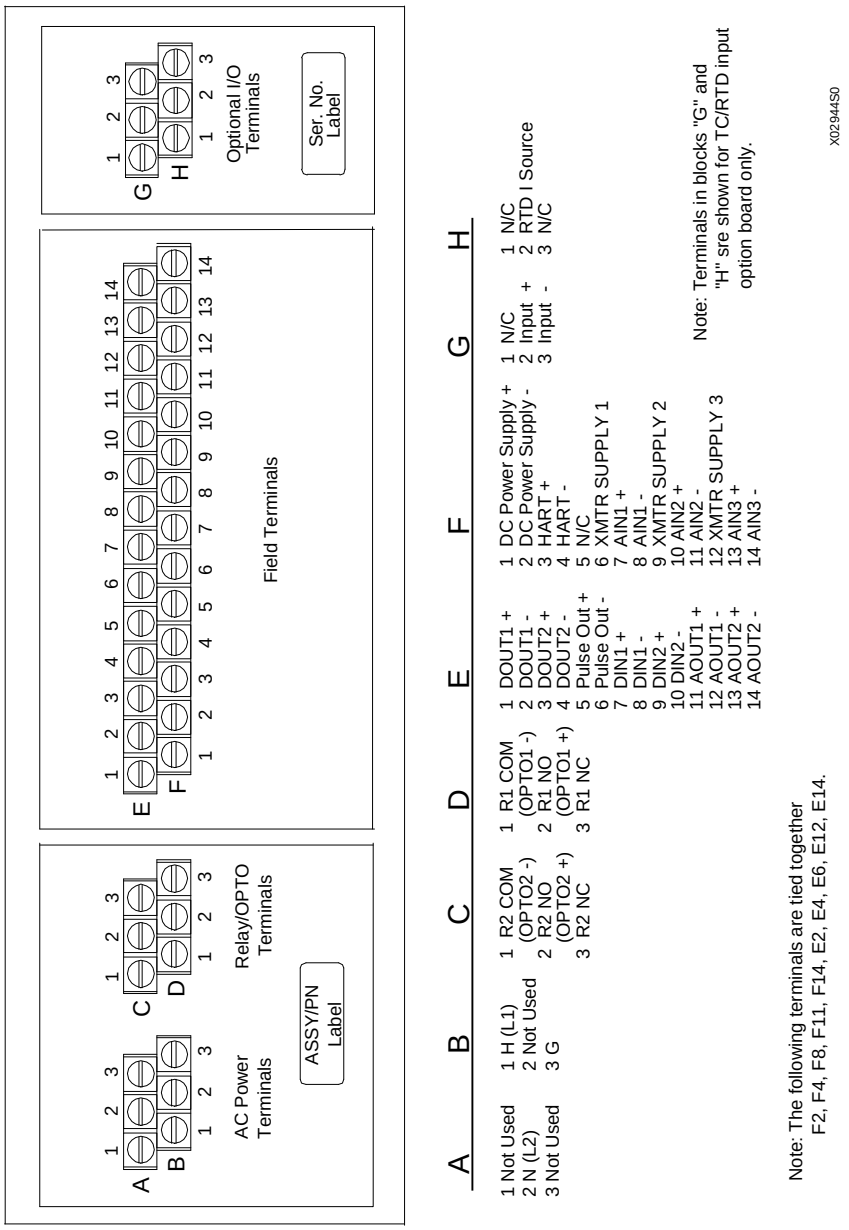


FIGURE 2-5 Electrical Connections

'**F2**' SIGNAL COMMON is ***isolated*** from case ground, terminal '**B3**'. Digital input commons are also isolated from the station common and case ground.

In summary, the following terminals are tied to '**F2**'(SIGNAL COMMON): 'F4', 'F8', 'F11', 'F14', 'E2', 'E6', 'E12', and 'E14'.

Analog inputs must be voltage inputs. When a current input (e.g., 4 to 20 mA) is to be applied to the FIELDPAC, a precision range resistor must be placed across the input terminals. A range resistor may not be required if the input is wired in parallel with other 1 to 5 Vdc receiving instruments.

Refer to loop diagrams and determine if a range resistor is required. Supplied range resistors are 250 ohms for 4 to 20 mA inputs.

2.4.3.1 Power Connections

A. AC POWER INPUT CONNECTIONS (Model 348EA)

Terminal '**B1**' is the AC supply HOT terminal.

Terminal '**A2**' is the AC supply NEUTRAL terminal.

Terminal '**B3**' is strapped to the instrument case and is the SAFETY GROUND terminal. It is usually connected to earth ground or to the power distribution safety ground (Green wire). Power input wires should be No. 14 AWG or heavier.

Refer to the “Power Requirements” section for permitted supply voltage range.

B. DC POWER INPUT CONNECTIONS (Model 348_D)

Terminal '**F1**' is the +24 Vdc power supply terminal.

Terminal '**F2**' is SIGNAL COMMON (power supply return).

Power input wires should be No. 14 AWG or heavier.

Refer to the “Power Requirements” section for permitted supply voltage range.

C. 2-WIRE TRANSMITTER SUPPLY OUTPUT (Model 348E only)

The 22 Vdc (nominal) power supply, rated at 80 mA maximum (short circuit protected), has its positive (+) output connected to terminals ‘F6’, ‘F12’ (negative side is SIGNAL COMMON). These terminals can be used to power up to three two-wire transmitters or be used to power the digital and pulse output circuits as long as the total current is limited to less than 80 mA. The terminals should not be used power up both a two-wire transmitter and a digital and pulse output circuit. Note that when an inductive load is switched, such as a relay, it may cause a momentary drop in transmitter output or an unexpected reset of the Smart Transmitter.

2.4.3.2 Signal Inputs And Outputs

A. ANALOG INPUTS

Each analog input is connected between an Analog Input (+) terminal and the Analog Input (-) terminal.

NOTE

Note that the Analog Input (-) terminals are internally connected to other SIGNAL COMMONs (analog output, digital output, and HART port common terminals) and should be connected to the user's instrument bus common. See Figure 2-6. Loop isolators are suggested when connecting 4-wire transmitters.

All analog inputs are factory calibrated 1 to 5 Vdc. For mA inputs, a range resistor must be connected across the analog input terminals. This precision (0.1%) resistor should be wire wound, 1/2 watt. Supplied range resistors are 250 ohms: quantity 3.

NOTE

250Ω Resistor recommended. Total network resistance must be greater than 230Ω or less than 1100Ω to support communication. A single 250Ω resistor is used when connected to multiple 348s.

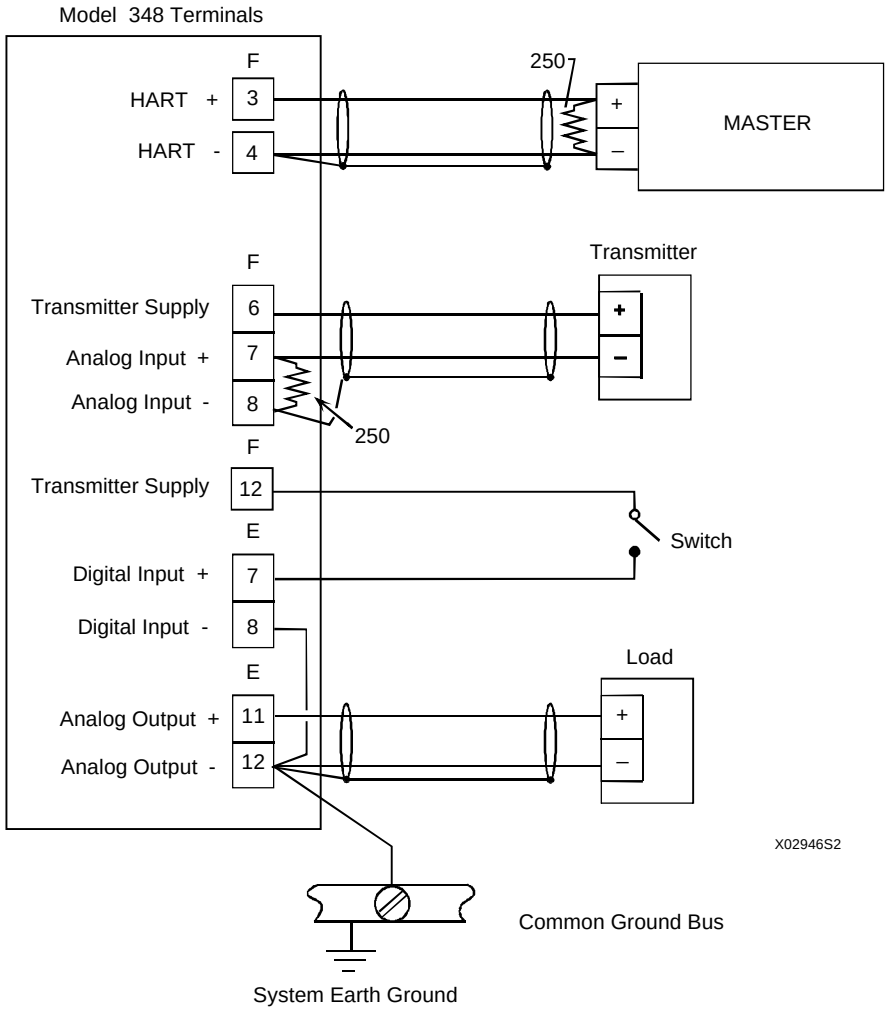


FIGURE 2-6 Model 348 Terminals

B. ANALOG OUTPUTS

Each analog output is connected between the Analog Output (+) terminal and the Analog Output (-) terminal. Note that Analog Output (-) terminals are internally connected to other SIGNAL COMMONs (analog input, HART port, and digital output common terminals) and should be connected to the user's instrument bus common. See Figure 2-6.

Standard analog output is factory calibrated for 4 to 20 mAdc referenced to station common.

C. DIGITAL INPUTS

Each digital input is connected between the Digital Input (+) terminal and Digital Input (-) terminal. The Digital Input
(-) terminals are isolated from each other, from other SIGNAL COMMONs, and from the station case (safety ground) terminal **'B3'**. See Figure 2-6.

An inductive source, such as a relay coil, must be shunted by either a transient suppression diode or resistor/capacitor suppression network to prevent damage to the FIELDPAC digital input circuit.

D. DIGITAL OUTPUTS

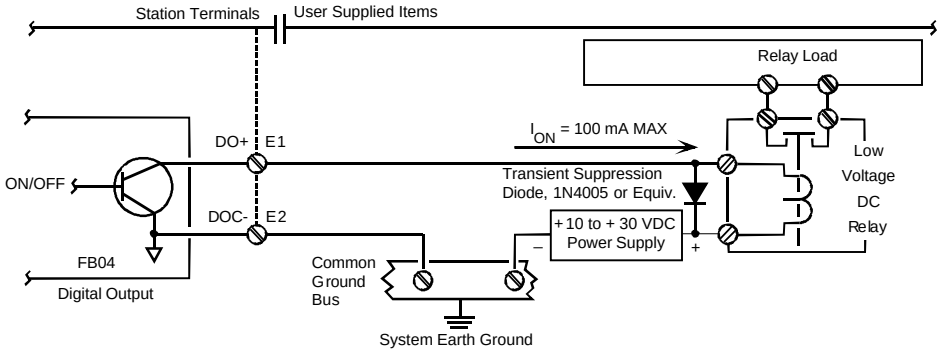
FIELDPACs have two open-collector type digital outputs. Each output is connected between a Digital Output (+) terminal and a Digital Output (-) terminal. Each Digital Output (-) terminal is internally connected to other SIGNAL COMMONs (analog input, analog output, and HART port common terminals) and should be connected to the user's instrument bus common.

These two digital output circuits use open-collector NPN transistors referenced to station common (see "Specifications" section). The load must limit current to 150 mA or less for each digital output (maximum transistor rating). An inductive load must be shunted by either a transient suppression diode or resistor/-capacitor suppression network to prevent damage to the FIELDPAC output circuit. See Figure 2-7.

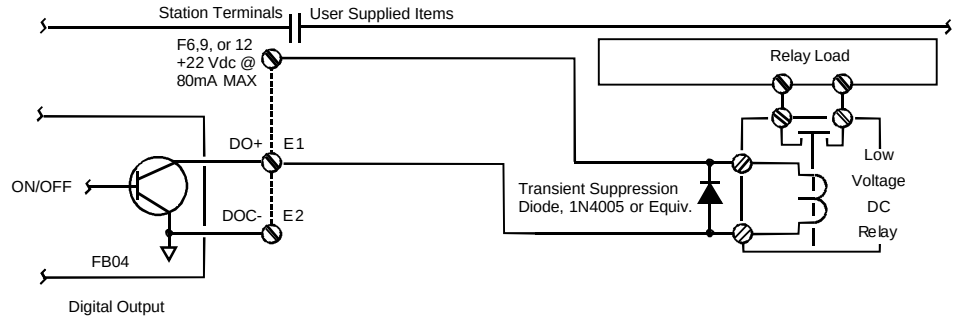
The voltage source for the external output loads can be the XMTR Supply terminals **'F6'**, **'F9'**, or **'F12'** (able to provide a total of 80 mA maximum), or a heavier capacity external power supply.

A Model 348S FIELDPAC has, in addition to the two digital outputs above, two opto-isolated open-collector NPN transistor output ports. OPTO1 is accessed via terminals **'D1'** (-) and **'D2'** (+). OPTO2 is accessed via terminals **'C1'** (-) and **'C2'** (+). Refer to "Specifications" section for detailed operating characteristics.

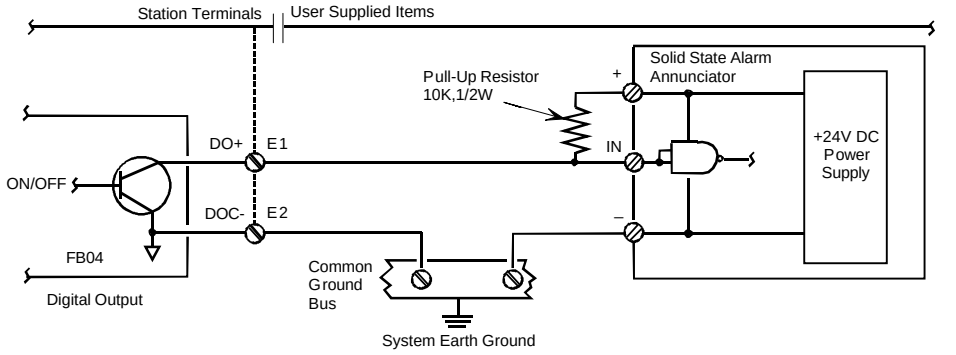
A Model 348E FIELDPAC is additionally equipped with two SPDT relay output ports. Relay 1 COM (Common) is accessed at terminal **'D1'**, Relay 1 NO (Normally Open) at **'D2'**, and Relay NC (Normally Closed) at **'D3'**. Similarly, Relay 2 COM is accessed at terminal **'C1'**, Relay 2 NO at terminal **'C2'**, and Relay 2 NC at terminal **'C3'**. Refer to "Specifications" section for detailed relay operating characteristics.



A. Relay Load and User Power Supply



B. Relay Load and Station +26V Power Supply



C. Solid State Loads (E.G., Alarm Annuniciator)

X02945SA

FIGURE 2-7 Digital Output to Typical Loads

E. PULSE OUTPUT

All FIELDPACs are equipped with an open-collector type pulse output. The pulse output is connected between the **'E5'** (Pulse Output +) terminal and the **'E6'** (Pulse Output -) terminal. Note that the Pulse Output (-) terminal is internally connected to other SIGNAL COMMONs (analog input, analog output, digital output, and HART port common terminals) and should be connected to the user's instrument bus common.

The pulse output circuit uses an open-collector NPN transistor referenced to station common (see section 1.3 for specifications). The load must limit current to 150 mA or less for each digital output (maximum transistor rating). An inductive load must be shunted by either a transient suppression diode or resistor/capacitor suppression network to prevent damage to the FIELDPAC output circuit.

The voltage source for the external output loads can be the XMTR Supply terminals **'F6'**, **'F9'**, or **'F12'** (able to provide a total of 80 mA maximum), or a heavier capacity external power supply.

F. HART COMMUNICATION

The HART Communication Link is connected between **'F3'** (HART +) terminal and **'F4'** (HART -) terminal. Note that the **'F4'** (HART -) terminal is internally connected to other SIGNAL COMMONs (analog input, analog output, pulse output, and digital output common terminals) and should be connected to the user's instrument bus common. See Figure 2-6.

G. MILLIVOLT/THERMOCOUPLE/RTD INPUT

Model 348____T FIELDPACs are equipped with the Temperature Sensor Board which accepts Millivolt, T/C, or RTD input signals. These signals are applied to terminal **'G2'** (Input +) and **'G3'** (Input -). The RTD current source is available at terminal **'H2'** (RTD I Source). All three of these terminals are isolated from other SIGNAL COMMONs (analog inputs, analog output, digital output, pulse output, and HART port common terminals). Refer to “Specifications” section for detailed operating characteristics. See Figure 2-8.

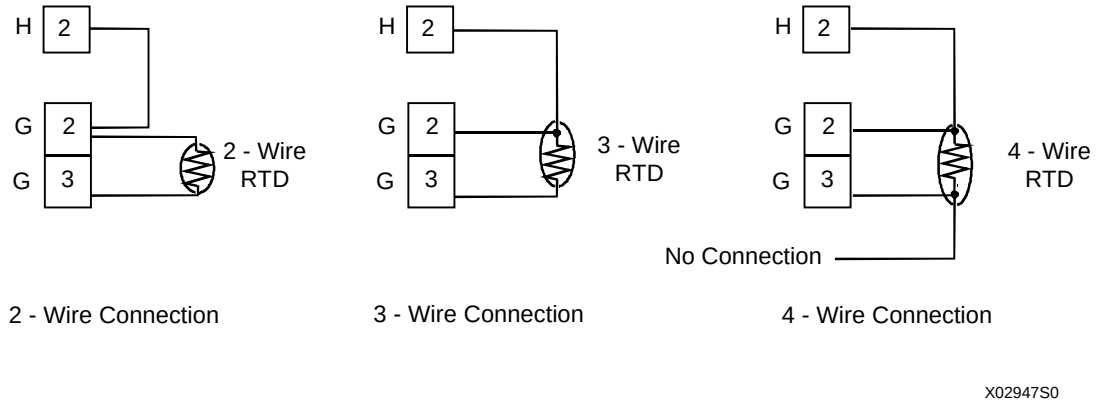


FIGURE 2-8 RTD Wiring Connections

Figure 2-5 shows the terminal compartment with terminal assignments and comments. Detailed electrical specifications are in section 1.3.

2.5 PNEUMATIC CONNECTIONS

Observe the following general guidelines when making pneumatic connections.

Blow out all piping before making connections.

Use pipe sealant sparingly and then only on the male threads. A non-hardening sealant is strongly recommended.

Leak-test all fittings and tube connections. There must be no leaks in any of the tubing.

2.5.1 Pneumatic Inputs

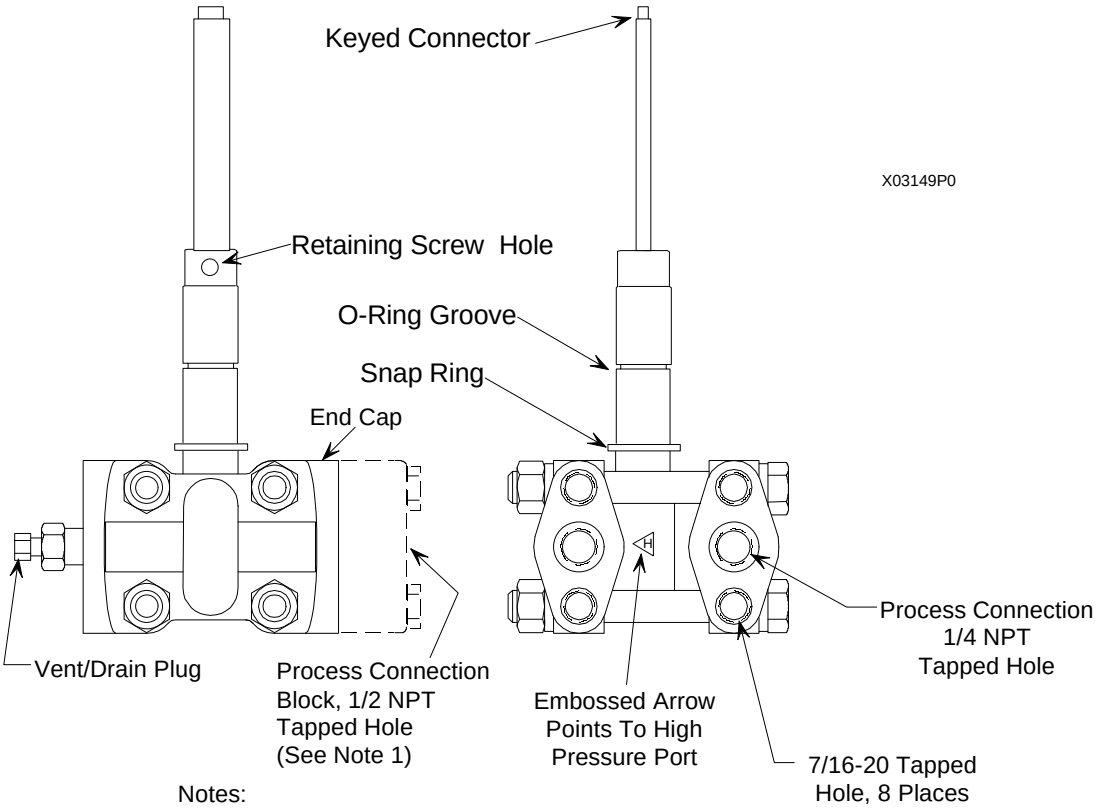
Some FIELDPAC models are equipped with pneumatic inputs (see "Specification" section). When appropriate, such pneumatic connections are made to the pneumatic ports marked **1**, **2**, and **3** on the right side of the FIELDPAC. Figure 1-1 shows the location of these ports.

2.5.2 Pneumatic Outputs

Some FIELDPAC models are equipped with pneumatic outputs (see "Specification" section). When appropriate, this pneumatic connection is made to port marked **O** (Output). An air supply must be connected to port **S** (Supply) for the pneumatic output option to work. Figure 1-1 shows the exact location of these ports.

2.5.3 Direct Pressure Input

Direct pressure sensors are shown in Figures 1-2 and 2-9 through 2-13. A sensor mounts on a FIELDPAC backplate. Figure 2-9 shows a Model 340D differential pressure sensor or a Model 340A or G sensor with a tantalum diaphragm, used for absolute or gauge pressure measurement. Note the embossed arrow that points to the high pressure port. Figure 2-10 shows the other Model 340A and G sensors. For detailed information about a sensor, see GC340 or UM340-1.

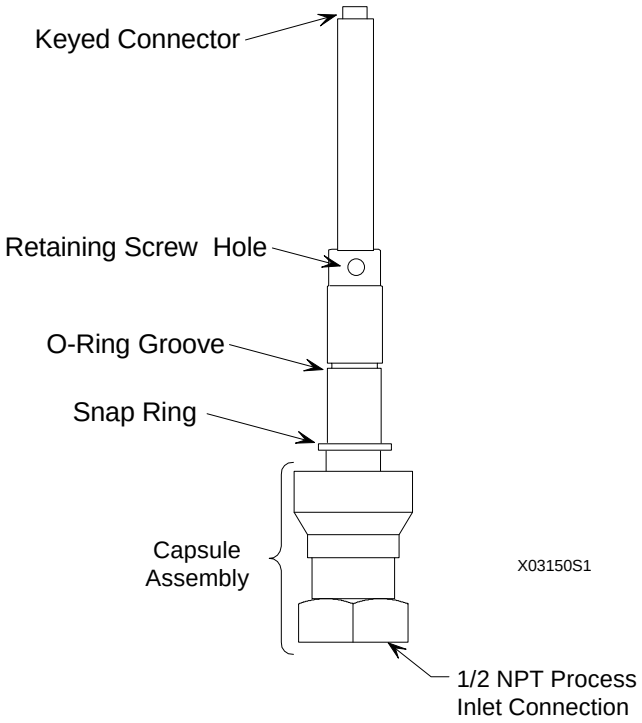


Notes:

1. Process Connection Blocks can be rotated 180º to give the following connection centers: 2.00 (50.1), 2.13 (54.1), or 2.25 (57.2). Dimensions are in inches (millimeters).

2. Also shows Models 340A and 340G with tantalum diaphragms.

FIGURE 2-9 Model 340D Differential Pressure Sensor (See Note 2)



Note:
1. For a Model 340A or G with tantalum diaphragms, see Figure 2.

FIGURE 2-10 Model 340A and Model 340G Pressure Sensors (See Note 1)

Figures 2-11, 12, and 13 show various piping arrangements. While the figures show a complete transmitter (i.e., housing and sensor), piping to the sensor is identical.

PRESSURE SENSOR IMPULSE PIPING RECOMMENDATIONS

Impulse piping is the piping to be connected to the sensor's process connection(s). For suggested flow and level measurement piping arrangements, refer to Figures 4, 5, and 6. If additional information is needed, order UM340-1, User's Manual for XTC Transmitters, Series 340 Pressure Transmitter-Controllers. UM340-1 from either your local Moore representative or the factory.

Note the following when planning and installing piping.

- Install impulse piping in accordance with ANSI Code B31.1.0.
- Make impulse piping length as short as possible to reduce frictional loss and temperature-induced pressure variations. However, when using impulse lines on a high temperature process, locate the Model 348 far enough

away from the heat source to keep it within temperature specifications [10°C (50ºF) per foot cooling to a normal ambient is assumed for uninsulated impulse lines].

- For lines between the process and sensor, use impulse piping of 3/8" OD or larger to avoid friction effects (causes lagging) and blockage.
- Use the least number of fittings and valves possible to minimize leakage problems. Teflon® tape is the recommended thread sealant for process connections at the sensor.
- Valves used in pressure service should be either globe or gate type. Valves used in gas service should be of a type that does not permit condensate to build up behind the valve.
- Install sediment chambers with drain valves to collect solids suspended in process liquids or moisture carried with non-condensing gases.
- Install air chambers with vent valves at high point in piping to vent gas entrained in process liquid.
- Remote diaphragm seals can be used to keep corrosive liquid or gas from the sensor's pressure inlets and isolation diaphragm [see ITT Conoflow Diaphragm Seals (PI34-6) for details].
  Alternatively, use sealing fluid to isolate the process from the sensor. Sealing fluid must be of greater density than process fluid and non-miscible.
- For a sensor located above the process, slope piping from the FIELDPAC at least 1 inch/foot (83 mm/M) down toward process. For a sensor below the process, slope piping at least 1 inch/foot (83 mm/M) up to process.
- Protect pressure lines (by shielding if necessary) from objects or equipment that may bend or kink the line causing fluid flow restriction.
- Protect the pressure lines from extreme temperature ranges. Lines should be protected from freezing by installing a heat trace.

A three-valve manifold should be used with a Model 340D sensor. A two-valve manifold can be used with a Model 340A or G sensor to permit servicing and zero checks.

2.6 FACTORY CALIBRATION

Unless a special calibration is ordered, the factory calibration is as follows:

Analog input function blocks....1 to 5 Vdc

Analog output function blocks...4 to 20 mA

Digital input and output ports do not require calibration.

Factory calibration of pneumatic I/O ports depends on the FIELDPAC model number (refer to Table 1-1 for exact specifications).

The Millivolt/thermocouple/RTD input board option is factory calibrated for all thermocouple and RTD input types. Calibration as stored on the Thermocouple/RTD board.

2.7 CONFIGURATION

The station must be configured before it can be placed on-line. Refer to "Configuration" and "Function Block Description" sections for configuration information.

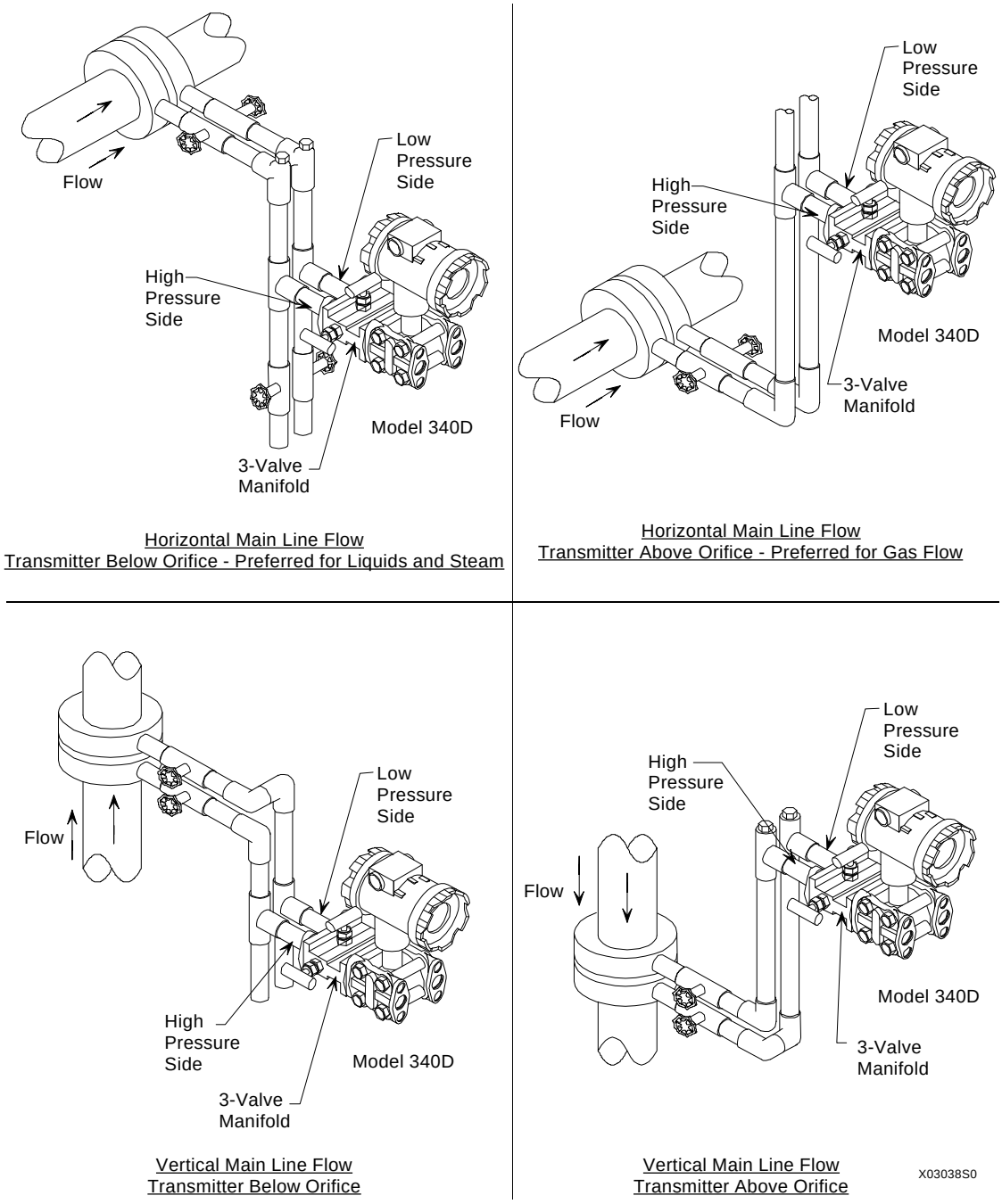


FIGURE 2-11 Differential Flow Measurement Piping for Gas and Liquid

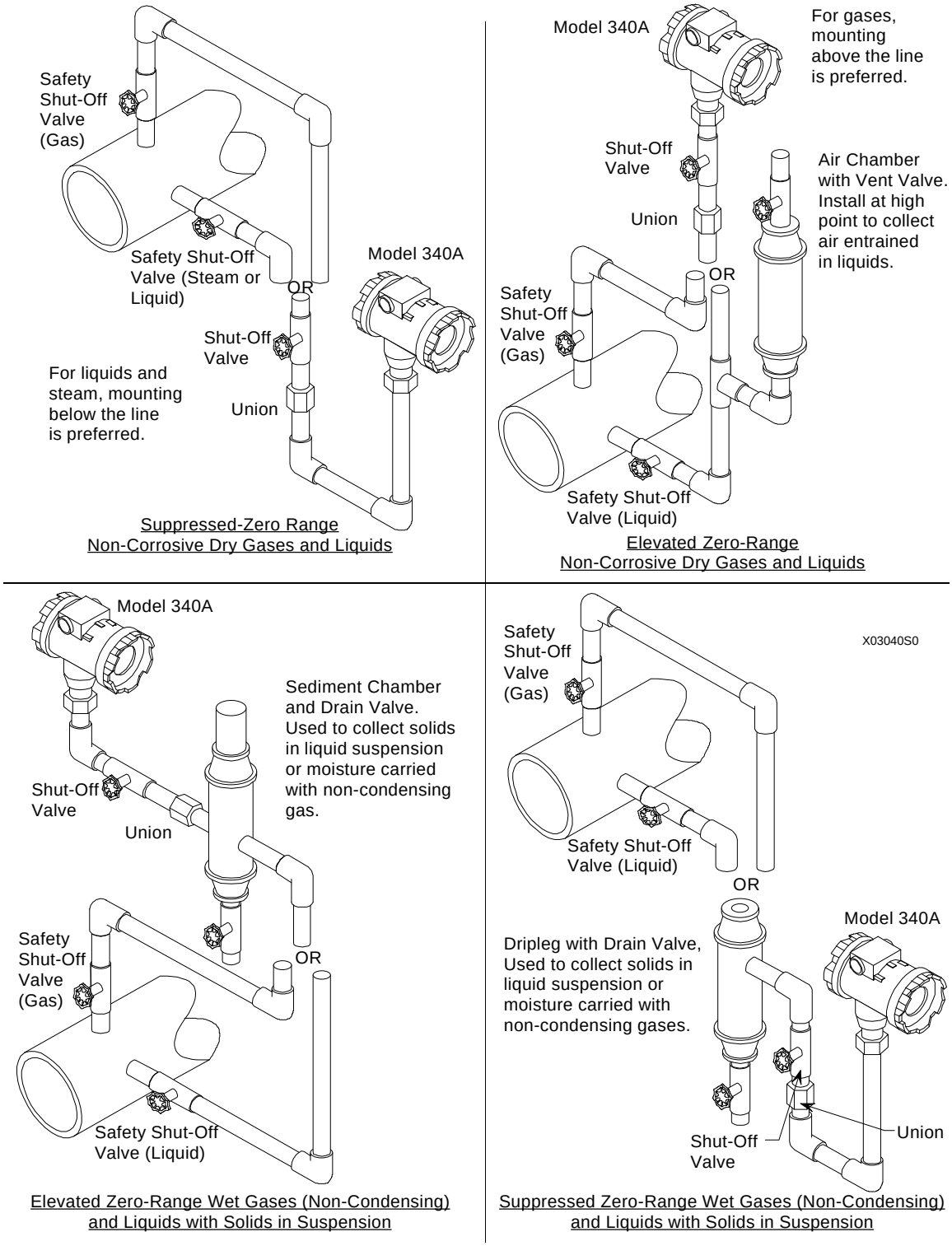


FIGURE 2-12 Absolute or Gauge Pressure Measurement Piping

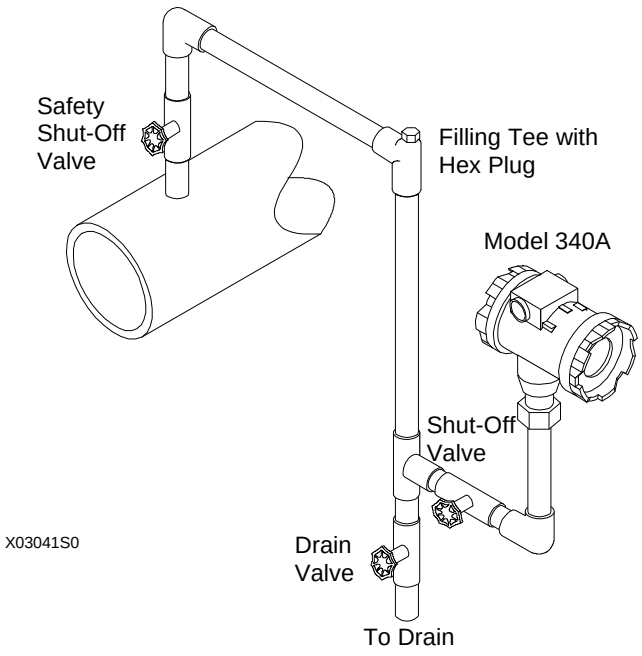


FIGURE 2-13 Steam Service, Below the Line Mounting

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3.0 OPERATION

This section describes the faceplate of the Moore FIELDPAC Field Mounted Controller. The faceplate consists of a centrally located Liquid Crystal Display (LCD) area surrounded by a keypad overlay. An optional LED backlight is available for faceplate illumination.

Some display elements and pushbuttons are used for both operation and configuration. This section describes their use for station operation only. For information about the display elements and pushbuttons used for configuring the FIELDPAC, refer to "Configuration" section.

Figure 3-1 identifies the display elements and pushbuttons explained in the following subsections.

3.1 FACEPLATE

3.1.1 Liquid Crystal Display Panel

The LCD panel contains several display elements which are described in the following subsections.

3.1.1.1 Multifunction Alphanumeric Display

The alphanumeric display at the top of the LCD consists of three sections. The left character is a 14-segment alphanumeric that identifies the numeric display variable as a process (P), a setpoint (S), a valve (V), or an output (O), and variables X and Y obtained via FB15. The ratio (R) from FB07, bias (B) from FB08, count (C), multiplier (M), preset 1 (1), and preset 2 (2) all from FB16 are also identified by this character.

The second section of the alphanumeric display consists of a minus sign and six 8-segment digits (with decimal point) which are used to display the numeric value of the variable. This part of the display is also used after pressing the TUNE or ALARM pushbutton to prompt the user to select Loop 1 or Loop 2.

The last section of the display consists of four full-segment alphanumeric characters that indicate engineering units, tag, or other descriptor. During normal operation, this portion of the display indicates the engineering units of the displayed variable. This display shows status information primarily related to function block states.

* U1 and U2 are alphanumeric characters specified by parameters 'HU1S' and 'HU2S'.

The display also shows the number of active status codes, e.g. H1*2 (indicates two conditions) or M1*3 (indicates three conditions). The ACK (acknowledge) pushbutton is used to scroll through the status display. Once a status condition is acknowledged, the status condition will be stacked behind the engineering units and can be viewed by the operator using the ACK pushbutton. The four decimal points in the display window will blink when a status is present.

The multifunction alphanumeric display is also used to view and select parameters during the configuration of the FIELDPAC.

TABLE 3-1 Status Information

STATUS CODE	STATUS TYPE	FUNCTION BLOCK NUMBER
A1, A2, A3, A4	Alarms	FB12
A5, A6, A7, A8	Alarms	FB73
H1, H2	High Limit	FB09, FB51
L1, L2	Low Limit	FB09, FB51
OR	Override	FB10
S1, S2	Standby Sync	FB14
M1, M2	Emergency Manual	FB14
U1*, U2*	User Defined Status	FB15
E	Station Error	See Section 6.0, Maintenance
P1	Totalizer Preset #1	FB16
P2	Totalizer Preset #2	FB16

3.1.1.2 Setpoint And Process Vertical Bargraphs

The two 20-segment vertical bargraphs located in the center of the LCD are normally used to display the setpoint (S) and process (P) variables in a 0 to 100% analog format, but can be configured to show different variables of the user's choice. The bargraphs can be configured to blink if an active alarm condition is encountered.

3.1.1.3 Valve or Output Horizontal Bargraph

A 20-segment horizontal bargraph at the bottom of the LCD is normally used to display either the valve position (closed or open) or the controller output (0 to 100%). When the bargraph is programmed to indicate valve position, it can be configured as direct (ATO) or reverse (ATC) acting.

3.1.1.4 PB1 And PB2 Triangle Indicators

Two triangle shaped LCD segments are provided for each PB1 and PB2 pushbutton.

When FB11 and/or FB23 is configured, these segments indicate the state (HI/LO) of the IS and ES status lines of each function block. Refer to FB11 and FB23 specifications in section 8 for additional information.

3.1.1.5 AUTO/MAN Triangle Indicators

Two triangle shaped LCD segments are provided for the AUTO/MAN pushbutton. When FB14 and/or FB55 is configured, these segments indicate the state of the MS status line of the function block(s). Refer to FB14 and FB55 specifications in section 8 for additional information.

3.1.2 Control Pushbuttons

Six large control pushbuttons are provided for the operator. Pushbuttons PB1, PB2, and AUTO/MAN are located on the left side of the LCD panel; pushbuttons D, UP ARROW, and DOWN ARROW are on the right side. The following subsections describe these pushbuttons in detail. Pushbuttons PB1 and PB2 can be customized for your application. Request Model 348 FIELDPAC™ Label Set for Customizing Faceplate Pushbuttons (AD348-1) from your local Moore representative.

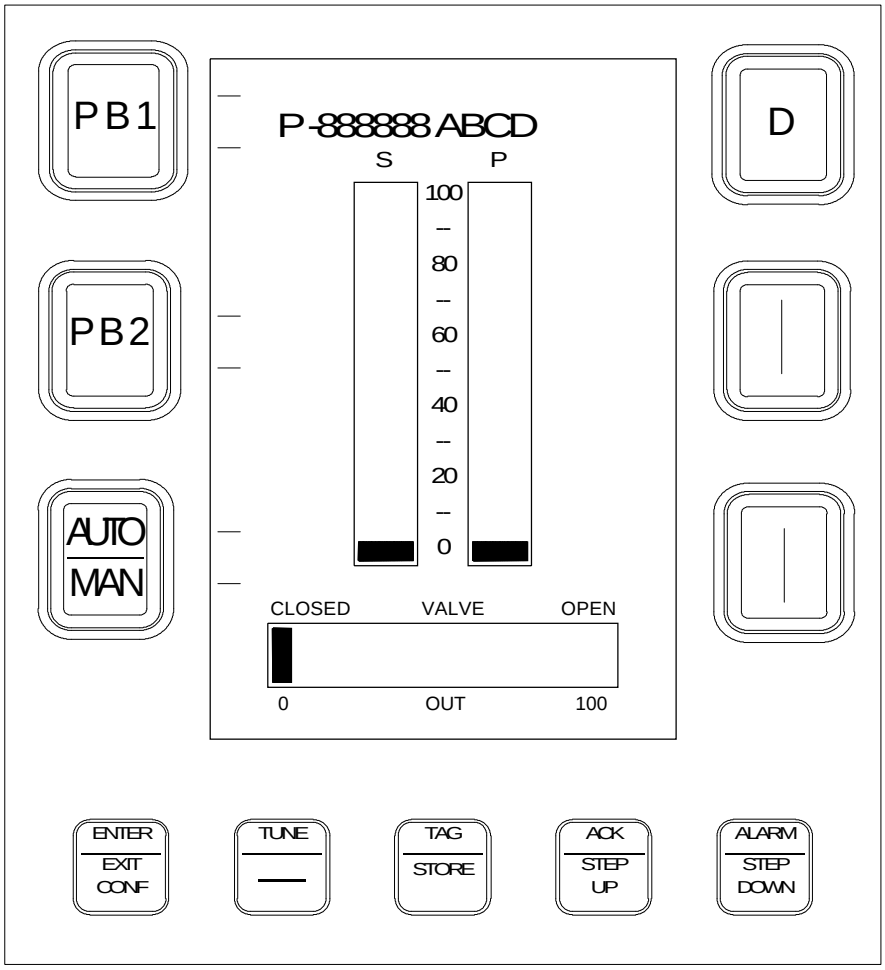

FIGURE 3-1 Operator Controls and Signal Displays

3.1.2.1 PB1

Pushbutton PB1 is a SPDT switch that can be configured to operate as a momentary or as a sustained action switch. FB23 is used to configure this switch. Two triangle indicator segments are provided next to the switch on

the LCD panel to show resultant switch action (see “PB1 and PB2 Triangle Indicators” section). If PB1 is not selected via the FB23 configuration (ESN=0), neither triangle segment is activated (visible).

3.1.2.2 PB2

Pushbutton PB2 is a SPDT switch that can be configured to operate as a momentary or as a sustained action switch. FB11 is used to configure this switch. Two triangle indicator segments are provided next to the switch on the LCD panel to show resultant switch action (see “PB1 and PB2 Triangle Indicators” section). If PB2 is not selected via the FB11 configuration (ESN=0), neither triangle segment is activated (visible).

3.1.2.3 AUTO/MAN

Pushbutton AUTO/MAN is a SPDT switch that toggles the controller's status between Automatic and Manual. FB14 is used to configure this switch. Two triangle indicator segments are provided next to the switch on the LCD panel to show resultant switch action (see “PB1 and PB2 Triangle Indicators” section). If the Auto/Manual Transfer Block is not selected via the FB14 or FB55 configuration (ESN=0), neither triangle segment is activated (visible).

3.1.2.4 D

The D pushbutton controls what type of information is displayed on the Multifunction Alphanumeric Display. Each discrete push of this switch advances the display to the next display category such as P (Process), S (Setpoint), V (Valve), or other variables that may be configured.

With the FIELDPAC in configuration mode, pushing D will move the decimal point during floating point entry and it will change cursor direction during ASCII character entry.

3.1.2.5 UP Arrow

The UP ARROW pushbutton is used to increase the value of the shown variable displayed on the Multifunction Alphanumeric Display (if this variable is allowed to be adjusted). These variables can be such settings as the setpoint, valve, output, tuning parameters, and alarm limits. Each discrete push of the button will increment the least significant digit on the display. If the button is held down for two seconds or more, the value will increment at an increased rate. The rate will accelerate up to a maximum the longer the button is held down.

3.1.2.6 DOWN Arrow

The DOWN ARROW pushbutton is used to decrease the value of the shown variable displayed on the Multifunction Alphanumeric Display (if this variable is allowed to be adjusted). These variables can be such settings as the setpoint, valve, output, tuning parameters, and alarm limits. Each discrete push of the button will

decrement the least significant digit on the display. If the button is held down for two seconds or more, the value will decrement at an increased rate. The rate will accelerate up to a maximum the longer the button is held down.

3.1.3 Dual-Function Pushbuttons

A row of five smaller pushbuttons is located directly below the LCD display panel. These pushbuttons have dual functions. With the FIELDPAC in normal operating mode, these buttons provide the operator with some secondary operating functions. With the FIELDPAC switched to the configuration mode, these buttons provide some functions for configuring the FIELDPAC.

3.1.3.1 ENTER/EXIT CONF

This pushbutton allows the user to enter and exit the configuration mode of the FIELDPAC. Each discrete push of this button toggles between "enter" and "exit".

3.1.3.2 TUNE/--->

With FIELDPAC in normal operating mode, this button permits quick access to FB13 and/or FB45 tuning parameters. After pressing the TUNE/---> button, LOOP 1 is displayed in the digital display. The user can toggle between LOOP 1 (FB13 Controller #1) and LOOP 2 (FB45 Controller #2) by pressing the TUNE/---> button again. The controller parameters accessible from this function are SA*, SPG*, STI*, STd*, SdG*, SMR*, SHL*, and SLL* where the * is 1 or 2 representing LOOP 1 or LOOP 2. Parameters SA1 and SA2, controller action, can only be viewed in this mode. All the other parameters can be viewed and changed.

With the FIELDPAC in configuration mode, each push of this button shifts the cursor to the right to the next parameter entry position until the end of the line where the cursor shifts back to the beginning again.

If the D pushbutton was used to change cursor direction during ASCII character entry, then the TUNE/--> pushbutton will shift the cursor to the left.

3.1.3.3 TAG/STORE

With FIELDPAC in normal operating mode, a push of this button will cause the four character display to scroll through the tag name of Loop 1, Loop 2, or both Loops. See FB15, Operator’s Display parameters, for more information.

With the FIELDPAC in configuration mode, pressing this pushbutton will store the entered parameter in the configuration data. The controller blocks (FB13 and FB45) are reinitialized each time a parameter is stored in configuration mode.

3.1.3.4 ACK/STEP UP

With FIELDPAC in normal operating mode, pressing this button will open the status window to view any active status conditions or it will acknowledge any flashing status conditions.

With the FIELDPAC in configuration mode, each push of this button will step the configuration menu up one level.

3.1.3.5 ALARM/STEP DOWN

With FIELDPAC in normal operating mode, pressing this button permits the operator to quickly access the alarm limits, deadband, and enable parameters associated with the alarm function blocks. After pressing the ALARM/STEP DOWN button, LOOP 1 is displayed in the digital display. The user can toggle between LOOP 1 (FB12 alarm parameters) and LOOP 2 (FB73 alarm parameters) by pressing the TUNE/---> button. Once the appropriated LOOP is selected, press the ALARM/STEP DOWN button to access the alarm parameters.

With the FIELDPAC in configuration mode, each push of this button will step the configuration menu down one level.

3.2 OPERATING MODES

The operating modes required for any FIELDPAC operation are dependent upon the user configuration of the station type and the control strategy. All typical operating modes for standard industrial controller types can be configured for use by the FIELDPAC.

Refer to sections 7 and 8 for more detailed information on all the FIELDPAC functions and its configuration procedure.

The **AUTO/MAN** (Automatic/Manual), **PB1** and **PB2** pushbutton mode switches are used to establish the operating modes locally. Any combination of these switches can be configured for use. Each mode switch has a corresponding function block from which the switch function or functions are selected.

3.3 DISPLAY TEST

Pushing the ENTER/EXIT CONF button followed by a push of the D button will activate all display segments of the Liquid Crystal Display. A three-step test is automatically performed on the alphanumeric display to activate all its segments. The two-button push sequence must be initiated when the Station is in the operating mode. If the Station is in the configuration mode when the ENTER/EXIT CONF and the D pushbuttons are pressed, the Station will exit configuration without performing a display test.

3.4 PUSHBUTTON CARE

Pushbuttons should be pressed by a finger, an unused eraser on a pencil, or a stick eraser. Use of a hard implement, such as the cap end of a pen, a blunt tool, or a fingernail, may deform the dome switch and result in pushbutton failure.

3.5 CONTRAST ADJUSTMENT

The LCD display has a contrast adjustment located at the top left of the display circuit board as shown in Figure 3-2. To adjust the contrast, rotate the contrast pot clockwise to make the display darker until the 'off' segments start to "ghost" on, then back off a quarter turn.

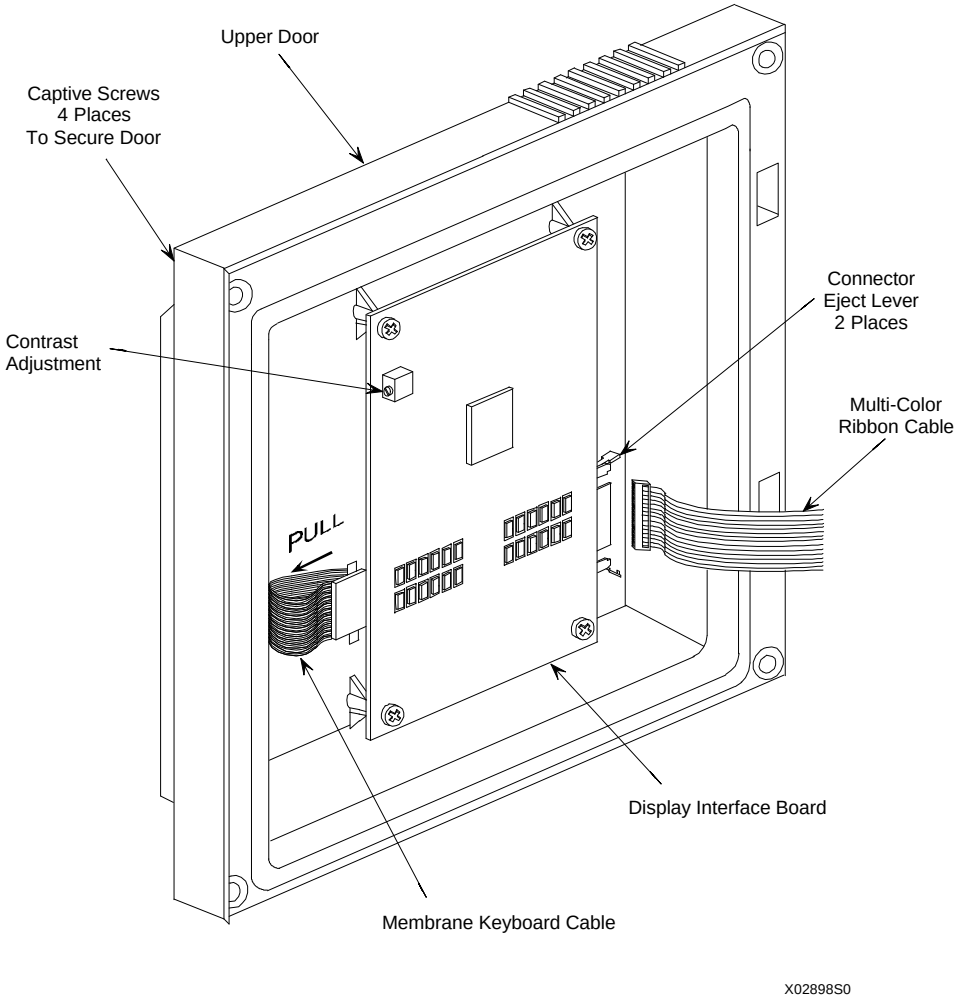

FIGURE 3-2 Display Contrast Adjustment

■

4.0 CALIBRATION

This section covers the calibration and calibration verification of the following function blocks (FBs) used in the Moore FIELDPAC Field Mounted Controllers.

FB01 Analog Input #1
FB02 Analog Input #2
FB03 Analog Output #1 / I/P Module
FB25 Analog Input #3
FB29 Analog Output #2
FB81 Pressure Sensor
FB82 Temperature Sensor
FB85 Pneumatic Input #1
FB86 Pneumatic Input #2
FB87 Pneumatic Input #3

Function blocks dealing with digital I/O do not have to be calibrated.

4.1 GENERAL CONSIDERATIONS

FIELDPAC units are calibrated at the factory will not have to be recalibrated for most applications. However, for critical applications, consider the following.

If a current to voltage conversion resistor (typically 250 ohm ±0.1%) is used at a particular analog input, that precision resistor should remain with the Station, installed across those particular terminals, to eliminate the voltage drop variation due to resistor tolerance. Use a precision current source for calibration.

Allow the FIELDPAC to warm-up for one hour prior to calibrating. The ambient temperature should be close to its expected operating temperature.

Periodic calibration is not necessary. However, calibration and verification should be performed under any of the following circumstances.

To check or change the calibration of a new or in-service FIELDPAC.

Upon replacing one of the following Boards: MPU Controller Board, or Pneumatic Input Board.

Upon the replacing or the repositioning of a Remote Pressure Sensor.

As part of a troubleshooting or failure confirmation routine.

Standard factory calibrations of the electrical analog input and output ports are listed in section 2.6. Standard calibrations of the pneumatic input and output ports can be determined from Table 1-1, Model Designation. Specifications can be found in “Specification” section.

A FIELDPAC is equipped with lockout switches which must be set to 'enabled' before certain calibration and configuration procedures can be performed. Refer to section 4.3, Lockout Switches, to enable the needed modes.

Calibration requires that each involved function block (FB) be assigned an execution sequence number (ESN). It can be any non-zero number. This procedure is described in section 4.4, ESN Assignment.
The bargraphs on the Display Assembly are not used during calibration. Ignore any bargraph indications.

Verify a FIELDPAC's model number and power input requirement before applying power. A FIELDPAC must be off-line during calibration.

4.2 REQUIRED EQUIPMENT

Calibration of the FIELDPAC requires the use of some or all of the following test equipment:

1. A precision voltage source capable of supplying 0.000 to 5.000 Vdc for calibrating analog input function blocks.

2. A precision current source capable of supplying 0.000 to 20.00 mAdc for calibrating analog inputs. Precision range resistors must be connected across input terminals.

3. A precision milliammeter capable of displaying 4.000 to 20.00 mAdc for calibrating the analog output function blocks.

   OR

   An electronic calibrator that combines the needed functions of the three instruments above.

4. A precision millivolt calibration source for required millivolt calibration range. The signal source must be adjustable to an accuracy of ±0.01% or better and provide a source resistance of 100 or less.

5. A precision resistance decade box with a range of 0 to 2000 ohms in steps of 5 ohms maximum. This decade box is used to calibrate the RTD input of the temperature sensor function block 82.

6. A precision test gauge with a 0 - 30 psig range and 0.02 psi per division resolution. This gauge is for calibration and verification of the pneumatic input function blocks.

7. A regulated air supply, consisting of an adjustable (0 - 30 psig) pressure regulator and necessary tubing, fittings, and valves. A Moore Model 40-30 or 41-30 Nullmatic® Pressure Regulator is recommended. This air supply is for use with item 6 above.

8. A vacuum pump capable of providing a vacuum of 0.5 psig (minimum) is required for the mounting position zero shift calibration of an absolute Pressure Sensor.

Select the required equipment from the above list and make it available for the planned calibration procedure.

4.3 LOCKOUT SWITCHES

Five Lockout Switches are located at the top center of the MPU Controller Board as shown in Figure 5-3. The following configuration modes can be locked out or enabled.

'SOFT' - Soft configuration parameter settings
'ALARM' - Alarm configuration settings
'TUNE' - Autotune parameter settings
'H/T/F' - Hard configuration, ESN, and FCO settings
'CAL' - Calibration parameter settings

The lockout switches are factory set to lockout (disable) the above listed modes. This prevents inadvertent changing of calibration and other configuration parameters from the front panel. To gain access to and set any of the lockout switches, perform the following steps:

1. Open the top front cover (with the display panel) to reveal the MPU Controller Board. It will be necessary to unscrew a captive screw in each corner of the front cover.

2. Refer to Figure 5-3 to locate the desired switch.

3. Press the **RIGHT** side of the switch to **ENABLE** the particular configuration mode.

4. Press the **LEFT** side of switch to **LOCK OUT** that configuration mode.

5. After setting all the desired lockout switches, close and secure (four screws) the front cover.

4.4 ESN ASSIGNMENT

Calibration and configuration procedures require that each involved function block (FB) be assigned an execution sequence number (ESN). Use the following procedure to assign an ESN to each function block that will be used in a subsequent calibration or configuration procedure. The following procedure is also useful for viewing, changing, or deleting (setting to zero) a previously assigned ESN.

1. Verify FIELDPAC's input power requirement. Apply power to FIELDPAC.

2. Ensure that the 'H/T/F' lockout switch is in the 'enabled' position. Refer to “Lockout Switches” section and Figure 5-3 to perform this task, if necessary.

3. Press ENTER/EXIT CONF pushbutton to enter configuration mode at the MENU level.

4. Push the DOWN/ARROW pushbutton to select 'T' (Table) on left digit position of alphanumeric display. (If 'TX' appears in the display, the 'H/T/F' lockout switch on the MPU Controller Board must be enabled, see “Lockout Switches” section).

5. Press ALARM/STEP DOWN pushbutton to enter FUNCTION BLOCK level.

6. Push the UP/ARROW or DOWN/ARROW pushbutton to select the desired function block number as displayed on the right side digits of alphanumeric display.

7. Press ALARM/STEP DOWN pushbutton to enter PARAMETER level. The alphanumeric display should show 'ESN' to the right of the already displayed 'T'. To the left of 'TESN' (in the center section of the display) will appear the currently assigned ESN.

8. Push the UP/ARROW or DOWN/ARROW pushbutton to select the desired ESN appearing in the center section of the display. It can be any positive whole number above 00. Use an ESN of 00 only to delete a function block from the configuration.

9. Press the TAG/STORE pushbutton to store the selected ESN.

10. Press the ACK/STEP UP pushbutton to get back to the FUNCTION BLOCK level and perform steps 6 through 9 for the next needed function block. When all required ESN assignments have been completed, press the ENTER/EXIT CONF pushbutton to exit the configuration mode.

4.5 ANALOG INPUTS AND OUTPUTS (FB01, FB02, FB03, FB25, FB29)

FIELDPAC analog input and analog output functions are factory calibrated: inputs, 1 to 5 Vdc; outputs, 4-20 mAdc. If calibration is necessary, use the following procedure.

Before proceeding with the calibration, refer to:
- "General Considerations" section for some general considerations.
- Obtain the necessary equipment from the list given in "Required Equipment" section
- Enable the appropriate lockout switches described in the "Lockout Switches" section.

1. Allow the FIELDPAC to warm-up for one hour prior to calibrating. The ambient temperature should be close to its expected operating temperature.

2. Ensure that the 'CAL' lockout switch is in the 'enabled' position. Refer to "Lockout Switches" section and Figure 5-3 to perform this task, if necessary.

3. Press ENTER/EXIT CONF pushbutton to enter configuration mode at the MENU level.

4. Push the UP/ARROW or DOWN/ARROW pushbutton to select 'C' (calibration) on left digit position of alphanumeric display. (If 'CX' appears in the display, the lockout switch on the MPU Controller Board must be enabled, see "Lockout Switches" section).

5. Press ALARM/STEP DOWN pushbutton to enter FUNCTION BLOCK level.

6. Push the UP/ARROW or DOWN/ARROW pushbutton to select desired analog input or analog output function block number on the right side digits of alphanumeric display. Refer to Table 4-1.

7. At FIELDPAC's terminals associated with the selected function block (see Table 4-1), connect either a voltage source (A) or a milliammeter (B):

   A. Precision voltage source for ***analog input*** calibration:

      Connect to the appropriate analog input terminals. Ensure that terminal screws are tight.

   B. Precision milliammeter for ***analog output*** calibration:

      Connect to the appropriate analog output terminals. Ensure that terminal screws are tight.

8. Press ALARM/STEP DOWN pushbutton to enter PARAMETER level.

9. Push the UP/ARROW or DOWN/ARROW pushbutton to select desired parameter (e.g., 'CZI1' for zero input 1, 'CZO1' for zero output 1, etc.). Parameter is indicated on alphanumeric display. See Table 4-1.

10. Press ALARM/STEP DOWN pushbutton to enter VALUE level ('CAL' should appear in the center section of the display).

11. For calibration, perform either A or B depending upon function block selected in step 6.

    A. Analog Input:

       1) Set precision voltage source to desired zero input value (0.000 to 1.000 Vdc).

       2) Wait at least 15 seconds, then press TAG/STORE pushbutton to store the zero input value.

       3) Press ACK/STEP UP pushbutton to get back to PARAMETER level.

       4) Push the UP/ARROW or DOWN/ARROW pushbutton to select full scale parameter ('CFI1' for full scale input 1, 'CFI2' for full scale input 2, etc.).

       5) Press the ALARM/STEP DOWN pushbutton to enter VALUE level ('CAL' should appear in the center section of the display).

       6) Set voltage source to desired full scale input value (4.000 to 5.000 Vdc).

       7) Wait at least 15 seconds, then press TAG/STORE pushbutton to store the full scale value.

       8) Proceed to step 12.

B. Analog Output

1) Push the UP/ARROW or DOWN/ARROW pushbutton to set zero output to 4.000 mA on digital multimeter or electronic calibrator.

2) Wait at least 15 seconds, then press TAG/ STORE pushbutton to lock-in desired value.

3) Press ACK/STEP UP pushbutton.

4) Push the UP/ARROW or DOWN/ARROW pushbutton ('CFO1' for full scale output 1 or 'CFO2' for full scale output 2).to select full scale parameter for the selected function block.

5) Press the ALARM/STEP DOWN pushbutton to enter VALUE level ('CAL' should appear in the center section of the display).

6) Push the UP/ARROW or DOWN/ARROW pushbutton to set full scale output to 20.00 mA on digital multimeter or electronic calibrator.

7) Wait at least 15 seconds, then press TAG/STORE pushbutton to store desired value.

12. To verify calibration, proceed to step 13. Verification is always recommended. If verification is not desired, proceed to step 14.

13. For verification, perform either A or B depending upon function block selected in step 6.

A. Analog Input

1) Press ACK/STEP UP pushbutton to get back to PARAMETER level.

2) Push the UP/ARROW or DOWN/ARROW pushbutton to select verification parameter (e.g., 'CVI1' to verify input 1, 'CVI2' for input 2, etc.). Parameter is shown on alphanumeric display. See Table 4-1.

3) Press ALARM/STEP DOWN pushbutton to enter VALUE level.

4) Set precision voltage source to zero input voltage value. The center section of the display should read 0.00% of input (tolerance: ±0.05%).

5) Set the voltage source to full scale input voltage value. The center section of the display should read 100.0% of input (tolerance: ±0.05%).

6) Proceed to step 14.

TABLE 4-1 Analog I/O Calibration Parameters

FUNCTION BLOCK	ANALOG CHANNEL	CALIBRATION PARAMETERS	ASSOCIATED TERMINALS
01	Input 1	CZI1 - Zero, Input #1 CFI1 - Full Scale, Input #1 CVI1 - Verify Input #1	F7(+), F8(-)
02	Input 2	CZI2 - Zero, Input #2 CFI2 - Full Scale, Input #2 CVI2 - Verify Input #2	F10(+), F11(-)
25	Input 3	CZI3 - Zero, Input #3 CFI3 - Full Scale, Input #3 CVI3 - Verify Input #3	F13(+), F14(-)
03	Output 1	CZO1 - Zero, Output #1 CFO1 - Full Scale, Output #1 CVO1 - Verify Output #1	E11(+), E12(-)
29	Output 2	CZO2 - Zero, Output #2 CFO2 - Full Scale, Output #2 CVO2 - Verify Output #2	E13(+), E14(-)

B. Analog Output

1) Press ACK/STEP UP button to get back to PARAMETER level.

2) Push the UP/ARROW or DOWN/ARROW pushbutton to select verification parameter (e.g., 'CVO1' verify analog output 1 or 'CVO2' for output 2). See Table 4-1.

3) Press ALARM/STEP DOWN pushbutton to enter VALUE level.

4) Push the UP/ARROW or DOWN/ARROW pushbutton to set the center section of the display to 0.00%. Output current should be 4.00 mA. (Acceptable tolerance: ±0.1%)

5) Push the UP/ARROW or DOWN/ARROW pushbutton to set 100.00%. Output current should read 20.00 mA. (Acceptable tolerance: ±0.1%)

6) Proceed to step 14.

14. Select one of the following:

    If all points have been calibrated and verified, press ENTER/EXIT CONF pushbutton to leave the calibration mode and enter operation mode.

    If additional function blocks are to be calibrated and verified, press ACK/STEP UP button twice to enter FUNCTION BLOCK level. Perform steps 6 through 13 for each function block to be calibrated and verified.

15. Having finished calibrating and verifying all the required function blocks, it is prudent to lock out the FIELDPAC's calibration mode via the MPU Controller Board's 'CAL' lockout switch.

This completes the calibration and verification procedure of the FIELDPAC's analog input and output functions.

4.6 PRESSURE SENSOR INPUT (FB81)

A Pressure Sensor may be installed in a FIELDPAC. Configuration of such a unit is handled by function block 81. These units are normally factory calibrated and configured to operate in the digital mode.

For most applications, recalibration of the factory-set pressure range will not be necessary. However, the mounting position zero shift calibration should be performed with the pressure sensor oriented in the expected field operating position.

The following subsections describe the mounting position zero shift calibration (see “Mounting Position Zero Shift Calibration” section) and an input pressure verification procedure (see “Calibration Verification” section).

4.6.1 Mounting Position Zero Shift Calibration

A slight zero shift will occur when a Pressure Sensor is installed and used in a different orientation than it was calibrated. The following calibration procedure corrects this shift.

Before proceeding with the calibration, refer to:

- “General Considerations” section for some general considerations.
- Obtain the necessary equipment (if needed) from the list given in the “Required Equipment” section.
- Enable the appropriate lockout switches described in “Lockout Switches” section
- Assign to FB81 a valid execution sequence number (ESN) as described in “ESN Assignment” section.

1. Orient the FIELDPAC with the attached Pressure Transmitter in the expected field operating position. With a FIELDPAC using a Remote Pressure Transmitter, only the Pressure Transmitter has to be oriented in the operating position.

2. Verify FIELDPAC's input power requirement. Apply power to the FIELDPAC. Allow the FIELDPAC and its connected Pressure Transmitter to warm-up for ten minutes before performing the zero shift calibration. The ambient temperature should be close to its expected operating temperature.

3. Perform the following to the input pressure port of the Transmitter:

   A. If it is a Absolute Pressure Transmitter sensor, connect a vacuum pump and draw a vacuum down to 0.5 psig minimum.

   B. If it is a D/P or Gage Pressure Transmitter sensor, disconnect any pressure tubing from the input port of the Transmitter, leaving it at atmospheric pressure.

4. Ensure that the 'CAL' lockout switch is in the 'enabled' position. Refer to “Lockout Switches” section and Figure 5-3 to perform this task, if necessary.

5. Press ENTER/EXIT CONF pushbutton to enter configuration mode at the MENU level.

6. Push the DOWN/ARROW pushbutton to select 'C' (calibration) on left digit position of alphanumeric display. (If 'CX' appears in the display, the lockout switch on the MPU Controller Board must be enabled, see “Lockout Switches” section).

7. Press ALARM/STEP DOWN pushbutton to enter FUNCTION BLOCK level.

8. Push the UP/ARROW or DOWN/ARROW pushbutton to select function block number 81 in the right side digits of alphanumeric display.

9. Press ALARM/STEP DOWN pushbutton to enter PARAMETER level. The alphanumeric display should show 'CMP' which stands for calibration of mounting position. Use UP/ARROW or DOWN/ARROW pushbuttons to make this selection if necessary.

10. Press ALARM/STEP DOWN pushbutton to enter VALUE level. The alphanumeric display should show 'CAL CMP'.

11. Press the TAG/STORE pushbutton to complete the mounting position zero shift calibration. The 'CAL' display will blink momentarily.

12. Press the ENTER/EXIT CONF pushbutton to leave the configuration mode.

13. Lock out the FIELDPAC's calibration mode via the MPU Controller Board's 'CAL' lockout switch.

This completes the mounting position zero shift calibration procedure.

4.6.2 Pressure Sensor Calibration Verification

The calibration of a Pressure Sensor connected to the FIELDPAC can be verified by the following procedure.

1. Check FIELDPAC's input power requirement. Apply power to the FIELDPAC. Allow the FIELDPAC and its connected Pressure Transmitter to warm-up for ten minutes before performing the calibration verification. The ambient temperature should be close to its expected operating temperature.

2. Connect a precision pressure source (capable of producing the necessary pressure calibration points) to the Pressure Sensor being verified.

3. Ensure that the 'CAL' lockout switch is in the 'enabled' position. Refer to “Lockout Switches” section and Figure 5-3 to perform this task, if necessary.

4. Press ENTER/EXIT CONF pushbutton to enter configuration mode at the MENU level.

5. Push the DOWN/ARROW pushbutton to select 'C' (calibration) on left digit position of alphanumeric display. (If 'CX' appears in the display, the lockout switch on the MPU Baseboard must be enabled, see “Lockout Switches” section).

6. Press ALARM/STEP DOWN pushbutton to enter FUNCTION BLOCK level.

7. Push the UP/ARROW or DOWN/ARROW pushbutton to select function block 81 in the right-side digits of the alphanumeric display.

8. Press ALARM/STEP DOWN pushbutton to enter PARAMETER level.

9. Press the UP/ARROW pushbutton to select the 'CVIP' parameter on alphanumeric display.

10. Press ALARM/STEP DOWN pushbutton to enter VALUE level. A digital value of the applied pressure should appear in the center (numeric) section of the display, just to the left of 'CVIP'.

11. Set the precision pressure source to the desired low, mid-range, and high calibration points and check the reading on the center section of the alphanumeric display. The reading is in % of calibrated range as set per FB81 parameters SMVL, SMVH, and SMVU

12. After completing the calibration verification, press the ENTER/EXIT CONF pushbutton to leave the calibration verification mode.

13. Lock out the FIELDPAC's calibration mode via the MPU Controller Board's 'CAL' lockout switch (see “Lockout Switches” section).

This completes the calibration verification procedure. If the verification results show that a recalibration is necessary, the Pressure Transmitter sensor should be replaced.

4.7 TEMPERATURE SENSOR INPUT (FB82)

The FIELDPAC may be equipped with a Temperature Sensor Board which can be configured to accept millivolt, thermocouple, or RTD inputs. Configuration of such a FIELDPAC is handled by Function Block 82.

These units are calibrated at the factory. The calibration data is stored on the Temperature Sensor Board

IMPORTANT

Temperature Board is factory calibrated using precision equipment. Do not calibrate unless board fails verification.

To change and/or verify the configuration and calibration parameters, follow the procedures outlined in the following subsections.

Before proceeding with the calibration, refer to:
- "Calibration section 4.1 for some general considerations
- Obtain the necessary equipment from the list given in "Required Equipment" section
- Enable the appropriate lockout switches described in "Lockout Switches" section
- Assign to FB82 a valid execution sequence number (ESN) as described in "ESN Assignment" section.

4.7.1 Selecting Input Type (MV, T/C, OHM, or RTD)

A FIELDPAC equipped with a Temperature Sensor Board can be configured to accept 18 types of input signals. Use the following procedure to set the required input type or to determine the current input configuration.

1. Verify FIELDPAC's input power requirement. Apply power to the FIELDPAC.

2. Ensure that the 'H/T/F' lockout switch is in the 'enabled' position. Refer to "Lockout Switches" section and Figure 5-3 to perform this task, if necessary.

3. Ensure that an ESN has been assigned to function block 82. Refer to "ESN Assignment: section to perform this task, if necessary.

4. Press ENTER/EXIT CONF pushbutton to enter configuration mode at the MENU level.

5. Push the DOWN/ARROW pushbutton to select 'H' (Hard Configuration) on left digit position of alphanumeric display. (If 'HX' appears in the display, the 'H/T/F' lockout switch on the MPU Controller Board must be enabled, see "Lockout Switches" section).

6. Press ALARM/STEP DOWN pushbutton to enter FUNCTION BLOCK level.

7. Push the UP/ARROW or DOWN/ARROW pushbutton to select function block number 82 on the right side digits of alphanumeric display.

8. Press ALARM/STEP DOWN pushbutton to enter PARAMETER level.

9. Push the UP/ARROW or DOWN/ARROW pushbutton until 'HIT' appears on the right side of the alphanumeric display.

10. Press ALARM/STEP DOWN pushbutton to enter VALUE level.

11. Push the UP/ARROW or DOWN/ARROW pushbutton to select the Input Type. It can be a number from 00 to 17 appearing on the center (numeric) section of the display. Calibration is performed using types 00, 05, 10, and 13 depending on the type of T/C or RTD being used. Refer to Table 4-2.

12. Press the TAG/STORE pushbutton to lock-in the desired input type.

13. Press the ENTER/EXIT CONF pushbutton to leave the hard configuration mode.

This completes the selection of the input type for the Temperature Sensor Board.

TABLE 4-2 Input Types And Calibration Values

TYPE NO.	DESCRIPTION	CALIBRATION VALUE	
		ZERO	FULL SCALE
0	Narrow Millivolt (Used when calibrating for Thermocouple Type R, S, T, or B)	-11 mV	+26 mV
5	Wide Millivolt (Used when calibrating for Thermocouple Type J, K, E, or N)	-18 mV	+103 mV
10	Narrow Ohm (Use when calibrating for RTD DIN 100, or RTD US 100)	0	470
13	Wide Ohm (Used when calibrating for RTD DIN 200, RTD DIN 500, RTD US 200, or RTD US 500)	0	1875

4.7.2 Specifying Measured Variable Units

A FIELDPAC equipped with a Temperature Sensor Board must be configured to display specific Measured Variable Units (MVUs) listed in Table 4-3. Use the following procedure to set the desired MVUs to be displayed.

1. Verify FIELDPAC's input power requirement. Apply power to the FIELDPAC.

2. Insure that the 'SOFT' lockout switch is in the 'enabled' position. Refer to “Lockout Switches” section and Figure 5-3 to perform this task, if necessary.

3. Insure that an ESN has been assigned to function block 82. Refer to “ESN Assignment” section to perform this task, if necessary.

4. Press ENTER/EXIT CONF pushbutton to enter configuration mode at the MENU level.

5. Push the DOWN/ARROW pushbutton to select 'S' (Soft Configuration) on left digit position of alphanumeric display. (If 'SX' appears in the display, the 'SOFT' lockout switch on the MPU Controller Board must be enabled, see “Lockout Switches” section).

6. Press ALARM/STEP DOWN pushbutton to enter FUNCTION BLOCK level.

7. Push the UP/ARROW or DOWN/ARROW pushbutton to select function block number 82 in the right side digits of alphanumeric display.

8. Press ALARM/STEP DOWN pushbutton to enter PARAMETER level.

9. Push the DOWN/ARROW pushbutton until 'SMVU' appears on the right side of the alphanumeric display.

10. Press ALARM/STEP DOWN pushbutton to enter VALUE level.

11. Push the UP/ARROW or DOWN/ARROW pushbutton to select the Measured Variable Units. It can be a number from 32 to 37 appearing on the center (numeric) section of the display. Refer to Table 4-3 for the six available Measured Variable Units.

12. Press the TAG/STORE pushbutton to lock-in the desired MVU.

13. Press the ENTER/EXIT CONF pushbutton to leave the soft configuration mode.

This completes the selection of the Measured Variable Units (MVUs) for the Temperature Sensor Board.

TABLE 4-3 List of Measured Variable Units

MVU NO.	DESCRIPTION
32	degrees Celsius
33	degrees Fahrenheit
34	degrees Rankine
35	Kelvin
36	Millivolts
37	Ohms

4.7.3 Millivolt Input Calibration

A FIELDPAC equipped with a Temperature Sensor Board can be calibrated to accept a narrow or a wide millivolt input range. Calibration of the FIELDPAC for millivolt inputs is handled by function block 82.

The complete calibration procedure entails selecting either the Narrow Millivolt or Wide Millivolt input type (Number 00 or 05, respectively), described in section 4.7.1, and carrying out the calibration steps listed below.

Before proceeding with the calibration, refer to:

- "General Considerations" section for some general considerations.
- Obtain the necessary equipment from the list given in "Required Equipment" section
- Enable the appropriate lockout switches described in "Lockout Switches" section
- Assign to FB82 a valid execution sequence number (ESN) as described in "ESN Assignment" section.

1. Verify FIELDPAC's input power requirement. Apply power to the FIELDPAC.

2. Allow the FIELDPAC to warm-up for one hour prior to calibrating. The ambient temperature should be close to its expected operating temperature.

3. Insure that the 'CAL' lockout switch is in the 'enabled' position. Refer to "Lockout Switches" section and Figure 5-3 to perform this task, if necessary.

4. Insure that an ESN has been assigned to function block 82. Refer to "ESN Assignment" section to perform this task, if necessary.

4.a Insure that function block 82 has been configured for either the Narrow Millivolt or Wide Millivolt input type in accordance with the intended application.

   For calibrating the Narrow Millivolt input type, the input type number should be set to 00.
   For calibrating the Wide Millivolt input type, the input type number should be set to 05.
   Refer to sections 4.7.1 and 4.7.2 to perform this task, if necessary.

5. Connect the precision millivolt source to FIELDPAC's optional I/O terminals **G2 (+)** and **G3 (-)**.

   Refer to Figure 4-1 for a typical calibration hook-up diagram and to Figure 2-5 for the physical location of the optional I/O terminals.

   Get lengths of No. 18 or No. 16 AWG insulated copper wire just long enough to conveniently locate the millivolt source near the FIELDPAC.

   Turn off power to the millivolt source.

   Make solid, low resistance connections. Do not use alligator or similar clips for connections. Observe polarity as indicated.

6. Press ENTER/EXIT CONF pushbutton to enter configuration mode at the MENU level.

7. Push the DOWN/ARROW pushbutton to select 'C' (calibration) on left digit position of alphanumeric display. (If 'CX' appears in the display, the lockout switch on the MPU Controller Board must be enabled, see section 4.3).

8. Press ALARM/STEP DOWN pushbutton to enter FUNCTION BLOCK level.

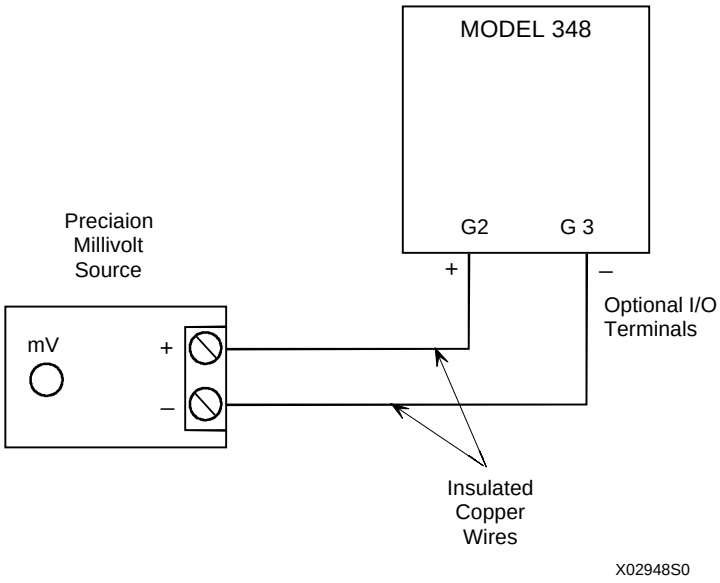

FIGURE 4-1 Thermocouple and Millivolt Input Calibration Wiring

9. Push the UP/ARROW or DOWN/ARROW pushbutton to select function block number 82 on the right side digits of alphanumeric display.

10. Press ALARM/STEP DOWN pushbutton to enter PARAMETER level.

11. Push the UP/ARROW or DOWN/ARROW pushbutton to select desired Zero parameter ('CWMZ' for wide millivolt zero or 'CNMZ' for narrow millivolt zero).

12. Press ALARM/STEP DOWN pushbutton to enter VALUE level ('CAL' should appear in the center section of the display).

13. Refer to Table 4-2 to obtain value in millivolts under Zero column for the type of millivolt input (Narrow or Wide) selected in “Selecting Input Type” section.

14. Set the millivolt source to the Zero value obtained in previous step.

15. Wait at least 15 seconds, then press TAG/STORE pushbutton to lock-in the Zero value. Wait until 'CAL' in the center display blinks - this indicates that the Zero value was stored successfully.

16. Press ACK/STEP UP pushbutton to get back to PARAMETER level.

17. Push the UP/ARROW or DOWN/ARROW pushbutton to select desired Full Scale parameter ('CWMF' for wide millivolt full scale or 'CNMF' for narrow millivolt full scale). This selection must agree with the input type selection made in section 4.7.1. Parameter is indicated on alphanumeric display.

18. Press the ALARM/STEP DOWN pushbutton to enter VALUE level ('CAL' should appear in the center section of the display).

19. Refer to Table 4-2 to obtain the value in millivolts under Full Scale column for the type of millivolt input (Narrow or Wide) selected in “Selecting Input Type” section.

20. Set the millivolt source to Full Scale value obtained in previous step.

21. Wait at least 15 seconds, then press TAG/STORE pushbutton to lock-in the Full Scale value. Wait until 'CAL' in the center display blinks - this indicates that the Full Scale value was stored successfully.

22. To verify calibration, proceed to step 23. Verification is always recommended. If verification is not desired, proceed to step 28.

23. Press ACK/STEP UP pushbutton to get back to PARAMETER level.

24. Push the UP/ARROW or DOWN/ARROW pushbutton to select Verification parameter 'CVIP'. Parameter is shown on alphanumeric display.

25. Press ALARM/STEP DOWN pushbutton to enter VALUE level.

26. Set precision millivolt source to Zero value (see step 13). The center (numeric) section of the display should read 0.00% of the scaled Zero input value (tolerance: ±0.05%).

27. Set precision millivolt source to Full Scale value (see step 19). The center (numeric) section of the display should read 100.0% of the scaled Full Scale input value (tolerance: ±0.05%).

28. After completing the calibration or calibration verification, press the ENTER/EXIT CONF pushbutton to leave the calibration mode.

29. Lock out the FIELDPAC's calibration mode via the MPU Controller Board's 'CAL' lockout switch.

This completes the calibration and calibration verification procedure. If the verification results show that a recalibration is necessary, perform steps 1 through 29 again.

4.7.4 Thermocouple Input Calibration

A FIELDPAC equipped with a Temperature Sensor Board can be calibrated to accept a variety of thermocouple types as shown in Table 4-2. Calibration of the FIELDPAC for any of the listed thermocouple types is handled by FB82.

The complete calibration procedure entails selecting either the Narrow Millivolt or Wide Millivolt input type (Number 00 or 05, respectively), described in “Selecting Input Type” section, and carrying out the calibration steps listed below.

The actual operating temperature range is entered as a soft 'S' configuration parameter after the calibration is completed. Once the FIELDPAC's thermocouple input is calibrated, FB82 Block Output 98 will produce a scaled and linearized signal using the values entered in the soft configuration so that the 0-100% signal will represent a specific operating temperature range. Refer to “Configuration” section for a detailed configuration procedure.

Before proceeding with the calibration, refer to:

- “General Considerations” section for some general considerations
- Obtain the necessary equipment from the list given in “Required Equipment” section
- Enable the appropriate lockout switches described in “Lockout Switches” section
- Assign to FB82 a valid execution sequence number (ESN) as described in “ESN Assignment” section.

1. Verify FIELDPAC's input power requirement. Apply power to the FIELDPAC.

2. Allow the FIELDPAC to warm-up for one hour prior to calibrating. The ambient temperature should be close to its expected operating temperature.

3. Ensure that the 'CAL' lockout switch is in the 'enabled' position. Refer to “Lockout Switches” section and Figure 5-3 to perform this task, if necessary.

4. Ensure that an ESN has been assigned to function block 82. Refer to “ESN Assignment” section to perform this task, if necessary.

4.a Insure that function block 82 has been configured for either the Narrow Millivolt or Wide Millivolt input type in accordance with the intended thermocouple type.

For calibrating thermocouple types ‘R,’ ‘S’, ‘T,’ and ‘B,’ the input type number should be set to 00.
For calibrating thermocouple types ‘J,’ ‘K’, ‘E,’ and ‘N,’ the input type number should be set to 05.
Refer to “Selecting Input Type” section and “Specifying Measured Variable Units” section to perform this task, if necessary.

5. Connect the precision millivolt source to FIELDPAC's optional I/O terminals **G2 (+)** and **G3 (-)**. Refer to Figure 4-1 for a typical calibration hook-up diagram and to Figure 2-5 for the physical location of the optional I/O terminals. Use No. 18 or No. 16 AWG insulated copper wires just long enough to conveniently locate the millivolt source near the FIELDPAC. Observe polarity as indicated. (Power off at the millivolt source.) Make sure all connections are solid, low resistance connections. Do not use alligator or similar clips for connections.

6. Press ENTER/EXIT CONF pushbutton to enter configuration mode at the MENU level.

7. Push the DOWN/ARROW pushbutton to select 'C' (calibration) in left digit position of alphanumeric display. (If 'CX' appears in the display, the lockout switch on the MPU Controller Board must be enabled, see “Lockout Switches” section).

8. Press ALARM/STEP DOWN pushbutton to enter FUNCTION BLOCK level.

9. Push the UP/ARROW or DOWN/ARROW pushbutton to select function block number 82 in the right side digits of alphanumeric display.

10. Press ALARM/STEP DOWN pushbutton to enter PARAMETER level.

11. Push the UP/ARROW or DOWN/ARROW pushbutton as needed to select the Zero Input parameter ('CNMZ' for thermocouples R, S, T, & B or 'CWMZ' for J, K, E, & N). This selection must agree with the input type selection made in section 4.7.1. Parameter is indicated on alphanumeric display.

12. Press ALARM/STEP DOWN pushbutton to enter VALUE level ('CAL' should appear in the center section of the display).

13. Refer to Table 4-2 to obtain value in millivolts under Zero column for the thermocouple type selected in “Selecting input Type” section.

14. Set the millivolt source to Zero value obtained in previous step.

15. Wait at least 15 seconds, then press TAG/STORE pushbutton to lock-in the Zero Input value. Wait until 'CAL' in center display blinks - this indicates that the Zero value was stored successfully.

16. Press ACK/STEP UP pushbutton to get back to PARAMETER level.

17. Push the UP/ARROW or DOWN/ARROW pushbutton as needed to select the Full Scale parameter ('CNMF' for thermocouples R, S, T, & B or 'CWMF' for J, K, E, & N). This selection must agree with the input type selection made in “Selecting Input Type” section. Parameter is indicated on alphanumeric display.

18. Press the ALARM/STEP DOWN pushbutton to enter VALUE level ('CAL' should appear in the center section of the display).

19. Refer to Table 4-2 to obtain value in millivolts under Full Scale column for the thermocouple type selected in “selecting Input Type section.

20. Set the millivolt source to Full Scale value obtained in previous step.

21. Wait at least 15 seconds, then press TAG/STORE pushbutton to lock-in the Full Scale value. Wait until 'CAL' in center display blinks - this indicates that the Full Scale value was stored successfully.

22. To verify calibration, proceed to step 23. Verification is always recommended. If verification is not desired, proceed to step 27.

23. Push the UP/ARROW or DOWN/ARROW pushbutton to select verification parameter 'CVIP'. Parameter 'CVIP' is a 0 to 100% signal scaled by the range set in parameters 'SMVL' and 'SMVH' and in the engineering units set in parameter 'SMVU'. Refer to step 24A to verify calibration with Input Type (HIT) set to 0 or 5. If verifying calibration in temperature units, refer to step 24B.

24A. Calibration verification in mV [with Input Type 0 (Narrow Millivolt) or 5 (Wide Millivolt)].

1. When verifying FB82 with Input Type 0 (Narrow Millivolt) or 5 (Wide Millivolt), parameter 'SMVU' should be set to 36 (mV) with 'SMVL' set to -11.0 mV and 'SMVH' set to +26.00 mV. Refer to "Selecting Input Type" section and "Specifying Measured Variable Units" for how to select Input Type and Measure Variable Units.

2. Continuing from step 23, press ALARM/STEP DOWN pushbutton to enter VALUE level of parameter 'CVIP'.

3. Set the millivolt source to -11.00 mV. The center (numeric) section of the display should read 0.00% (tolerance: ± 0.05%).

4. Set the millivolt source to +26.00 mV. The center (numeric) section of the display should read 100.00% (tolerance: ± 0.05%).

5. Proceed to step 25

24B. Calibration Verification Temperature Units (with Input Type 11, 12, 14, 15, 16, 17).

1. When verifying FB82 in Temperature Units, the Input Type must match the thermocouple type (or curve) being used. Refer to "Selecting Input Type" section to set the Input Type (parameter 'HIT', i.e. 6 for J Type).

2. The Measure Variable Units should be set to the temperature scale desired (i.e. 32 for ºCelsius). Refer to "Specifying Measured Variable Units" section for how to set parameter 'SMVU'.

3. Set parameters 'SMVL' and 'SMVH' to your range low and high values (i.e. 0.00 and 500.00).

4. Continuing from step 23, press ALARM/STEP DOWN pushbutton to enter value level of parameter 'CVIP'.

5. Choose a low temperature and high temperature value on your scale to verify the calibration and note there respective voltages [i.e. 0º Celsius (0.00 mV) and 500º Celsius (27.388 mV)].

6. Set the millivolt source to the millivolt value corresponding to your chosen low range (i.e. 100.00 mV). The center (numeric) section of the display should read the percentage corresponding to your chosen low temperature scaled by parameters 'SMVL' and SMVH' (i.e. 0.0%).. Tolerance: ± 0.05%.

7. Set precision decade box to the ohms value corresponding to your chosen high range (i.e. 27.388 mV). The center (numeric) section of the display should read the percentage corresponding to your chosen high temperature scaled by parameters ‘SMVL’ and SMVH’ (i.e. 100.00%). Tolerance: ± 0.05%.

8. Proceed to step 25.

25. After completing the calibration or calibration verification, press the ENTER/EXIT CONF pushbutton to leave the calibration mode.

26. Lock out the FIELDPAC's calibration mode via the MPU Controller Board's 'CAL' lockout switch.

This completes the calibration and calibration verification procedure. If the verification results show that a recalibration is necessary, perform steps 1 to 26 again.

4.7.5 RTD Input Calibration

A FIELDPAC equipped with a Temperature Sensor Board can be calibrated to accept a variety of platinum resistance temperature detectors (RTDs). Calibration of the FIELDPAC for RTD input is handled by function block 82.

The complete calibration procedure entails selecting either the Narrow Ohm or Wide Ohm input type (Number 10 or 13, respectively), described in “Selecting Input Type” section, and carrying out the calibration steps listed below.

The actual operating temperature range is entered as a soft 'S' configuration parameter after the RTD calibration is completed. Once the FIELDPAC's RTD input is calibrated, FB82 Block Output 98 will produce a scaled and linearized signal using the values entered in the soft configuration so that the 0-100% signal will represent a specific operating temperature range. Refer to the “Configuration” section for detailed configuration information.

Before proceeding with the calibration, refer to:
- “General Considerations” section for some general considerations
- Obtain the necessary equipment from the list given in “Required Equipment” section
- Enable the appropriate lockout switches described in “Lockout Switches” section
- Assign to FB82 a valid execution sequence number (ESN) as described in “ESN Assignment” section.

1. Verify FIELDPAC's input power requirement. Apply power to the FIELDPAC.

2. Allow the FIELDPAC to warm up for one hour prior to calibrating. The ambient temperature should be close to its expected operating temperature.

3. Ensure that the 'CAL' lockout switch is in the 'enabled' position. Refer to “Lockout Switches” section and Figure 5-3 to perform this task, if necessary.

4. Ensure that an ESN has been assigned to function block 82. Refer to “ESN Assignment” section to perform this task, if necessary.

4.a Ensure that function block 82 has been configured for either the Narrow Ohm or Wide Ohm input type in accordance with the RTD type.

For calibrating RTD types 'DIN 100,' and 'US 100,' the input type number should be set to 10.
For calibrating RTD types 'DIN 200,' 'DIN 500', 'US 200,' and 'US 500,' the input type number should be set to 13.
Refer to "Selecting Input Type" section and "Specifying Measured Variable Input" section to perform this task, if necessary.

5. Connect the precision resistance decade box to the FIELDPAC's optional I/O terminals **G2** (+), **G3** (-), and **H2** (Current Source). To obtain proper lead resistance compensation during calibration, three equal lengths of No. 18 or No. 16 AWG wire must be used as in a 3-wire RTD connection shown in Figure 4-2.

   Ensure that the three equal leads make good electrical contact both at the decade box and the optional I/O terminals of the FIELDPAC. Do not use alligator clips for connections on either end, since contact resistance may be present and alter the calibration accuracy.

6. Press ENTER/EXIT CONF pushbutton to enter configuration mode at the MENU level.

7. Push the DOWN/ARROW pushbutton to select 'C' (calibration) on left digit position of alphanumeric display. (If 'CX' appears in the display, the lockout switch on the MPU Baseboard must be enabled, see "Lockout Switches" section).

8. Press ALARM/STEP DOWN pushbutton to enter FUNCTION BLOCK level.

9. Push the UP/ARROW or DOWN/ARROW pushbutton to select function block number 82 in the right side digits of alphanumeric display.

10. Press ALARM/STEP DOWN pushbutton to enter PARAMETER level.

11. Push the UP/ARROW or DOWN/ARROW pushbutton to select desired Zero parameter ('CWOZ' for 500 or 200 Ohm RTDs or 'CNOZ' for 100 Ohm RTD). This selection must agree with the input type selection made in "Selecting Input Type" section. Parameter is indicated on alphanumeric display.

12. Press ALARM/STEP DOWN pushbutton to enter VALUE level ('CAL' should appear in the center section of the display).

13. Set the precision resistance decade box to zero ohms.

14. Wait at least 15 seconds, then press TAG/STORE pushbutton to lock-in the Zero value. Wait until 'CAL' in center display blinks - this indicates that the Zero value was stored successfully.

15. Press ACK/STEP UP pushbutton to get back to PARAMETER level.

16. Push the UP/ARROW or DOWN/ARROW pushbutton to select desired Full Scale parameter ('CWOF' for 500 or 200 Ohm RTDs or 'CNOF' for 100 Ohm RTD). This selection must agree with the input type selection made in “Selecting Input Type” section. Parameter is indicated on alphanumeric display.

17. Press the ALARM/STEP DOWN pushbutton to enter VALUE level ('CAL' should appear in the center section of the display).

18. Refer to Table 4-2 to obtain value in ohms under the Full Scale column for the RTD type selected in “Selecting Input Type” section.

19. Set the precision resistance decade box to the Full Scale value obtained in previous step.

20. Wait at least 15 seconds, then press TAG/STORE pushbutton to lock-in the Full Scale value. Wait until 'CAL' in center display blinks - this indicates that the Full Scale value was stored successfully.

21. Press ACK/STEP UP pushbutton to get back to PARAMETER level.

22. To verify calibration, proceed to step 23. Verification is always recommended. If verification is not desired, proceed to step 27.

23. Push the UP/ARROW or DOWN/ARROW pushbutton to select verification parameter ‘CVIP’. Parameter ‘CVIP’ is a 0 to 100% signal scaled by the range set in parameters ‘SMVL’ and ‘SMVH’ and in the engineering units set in parameter ‘SMVU’. Refer to step 24A to verify calibration with Input Type (HIT) set to 10 or 13. If verifying calibration in temperature units, refer to step 24B.

24A. Calibration verification in ohms [with Input Type 10 (Narrow Ohm) or 13 (Wide Ohm)].

1. When verifying FB82 with Input Type 10 (Narrow Ohm) or 13 (Wide Ohm), parameter ‘SMVU’ should be set to 37 (Ohms) with ‘SMVL’ set to 0.00 and ‘SMVH’ set to 470.00. Refer to “Selecting Input Type” section and “Specifying Measured Variable Units” section for how to select Input Type and Measure Variable Units.

2. Continuing from step 23, press ALARM/STEP DOWN pushbutton to enter VALUE level of parameter ‘CVIP’.

3. Set precision decade box to zero ohms. The center (numeric) section of the display should read 0.00%. Tolerance: ± 0.05%.

4. Set precision decade box to 470.00 ohms. The center (numeric) section of the display should read 100.00%. Tolerance: ± 0.05%.

5. Proceed to step 25

24B. Calibration Verification in Temperature Units (with Input Type 11, 12, 14, 15, 16, 17).

1. When verifying FB82 in Temperature Units, the Input Type must match the RTD type (or curve) being used. Refer to "Selecting Input Type" section to set the Input Type (parameter 'HIT', i.e. 11 for DIN 100 curve).

2. The Measure Variable Units should be set to the temperature scale desired (i.e. 32 for Celsius). Refer to "Specifying Measured Variable Units" section for how to set parameter 'SMVU'.

3. Set parameters 'SMVL' and 'SMVH' to your range low and high values (i.e. 0.00 and 300.00).

4. Continuing from step 23, press ALARM/STEP DOWN pushbutton to enter value level of parameter 'CVIP'.

5. Choose a low temperature and high temperature value on your scale to verify the calibration and note there respective resistances [i.e. 0º Celsius (100.00 ohms) and 100º Celsius (138.5 ohms)].

6. Set precision decade box to the ohms value corresponding to your chosen low range (i.e. 100.00 ohms). The center (numeric) section of the display should read the percentage corresponding to your chosen low temperature scaled by parameters 'SMVL' and SMVH' (i.e. 0.0%).. Tolerance: ± 0.05%.

7. Set precision decade box to the ohms value corresponding to your chosen high range (i.e. 138.50 ohms). The center (numeric) section of the display should read the percentage corresponding to your chosen high temperature scaled by parameters 'SMVL' and SMVH' (i.e. 33.33%). Tolerance: ± 0.05%.

8. Proceed to step 25.

25. After completing the calibration or calibration verification, press the ENTER/EXIT CONF pushbutton to leave the calibration mode.

26. Lock out the FIELDPAC's calibration mode via the MPU Controller Board's 'CAL' lockout switch.

This completes the calibration and calibration verification procedure. If the verification results show that a recalibration is necessary, perform steps 1 through 26 again.

4.8 PNEUMATIC INPUT (FB85, FB86, FB87)

A FIELDPAC equipped with a Pneumatic Input Board can be calibrated to accept one or three (3-15 psig or 3-27 psig) pneumatic input signals. Four Pneumatic Input Boards are available:

1. P/N 16205-18 - Three inputs, 3-15 psig Board
2. P/N 16205-26 - Three inputs, 3-27 psig Board
3. P/N 16205-27 - One input, 3-15 psig Board
4. P/N 16205-28 - One input, 3-27 psig Board

FIELDPACs containing factory installed Pneumatic Input Boards are factory calibrated for either 3-15 psig or 3-27 psig, depending on Board used. For most applications, recalibration of the factory-set configuration and input range will not be necessary. However, if calibration or calibration verification is necessary, use the following procedure.

Calibration of the FIELDPAC for pneumatic input ports 1, 2, and 3 is handled by function blocks 85, 86, and 87, respectively.

IMPORTANT

Pneumatic Input function blocks 85, 86, and 87 are available (operational) only if Analog Input FB01 is not configured. Terminal '**F7**' used for FB01 must be left unconnected.

Refer to the Model 348 FILEDPAC Field Mounted Controller Configuration Guide (CG348A-2) for detailed configuration information.

Before proceeding with the calibration, refer to:

- "General Considerations" section for some general considerations
- Obtain the necessary equipment from the list given in "Required Equipment" section
- Enable the appropriate lockout switches described in "Lockout Switches" section
- Assign to FB82 a valid execution sequence number (ESN) as described in "ESN Assignment" section.

1. Verify FIELDPAC's input power requirement. Apply power to the FIELDPAC.

2. Allow the FIELDPAC to warm up for one hour prior to calibrating. The ambient temperature should be close to its expected operating temperature.

3. Ensure that the 'CAL' lockout switch is in the 'enabled' position. Refer to "Lockout Switches" section and Figure 5-3 to perform this task, if necessary.

4. Ensure that an ESN of 00 (zero) has been assigned to Analog Input function block 01. Refer to "ESN Assignment" section to perform this task, if necessary.

5. Ensure that an ESN has been assigned to function blocks 85, 86, and 87, as needed. Refer to "ESN Assignment" section to perform this task, if necessary.

6. Connect the precision 0-30 psig test gauge and the adjustable regulated air signal to the pneumatic input to be calibrated. Figure 1-1 shows the location of the three pneumatic input ports.

7. Press ENTER/EXIT CONF pushbutton to enter configuration mode at the MENU level.

8. Push the DOWN/ARROW pushbutton to select 'C' (calibration) on left digit position of alphanumeric display. (If 'CX' appears in the display, the lockout switch on the MPU Controller Board must be enabled, see “Lockout Switches” section).

9. Press ALARM/STEP DOWN pushbutton to enter FUNCTION BLOCK level.

10. Push the UP/ARROW or DOWN/ARROW pushbutton to select function block 85, 86, or 87 in the right-side digits of the alphanumeric display.

11. Press ALARM/STEP DOWN pushbutton to enter PARAMETER level.

12. Push the UP/ARROW or DOWN/ARROW pushbutton to select Zero Input parameter ('CZI1' for FB85, 'CZI2' for FB86, etc.). Parameter is indicated on alphanumeric display.

13. Press ALARM/STEP DOWN pushbutton to enter VALUE level ('CAL' should appear in the center section of the display).

14. Set the air pressure to the Zero Input value (for example, 3 psig). Refer to “Input/Output Ports” section for pneumatic input specifications.

15. Wait at least 15 seconds, then press TAG/STORE pushbutton to lock-in the zero input value. Wait until 'CAL' in center display blinks - this indicates that the Zero Input value was stored successfully.

16. Press ACK/STEP UP pushbutton to get back to PARAMETER level.

17. Push the UP/ARROW or DOWN/ARROW pushbutton to select desired Full Scale Input parameter ('CFI1' for FB85, 'CFI2' for FB86, etc.). Parameter is indicated on alphanumeric display.

18. Press the ALARM/STEP DOWN pushbutton to enter VALUE level ('CAL' should appear in the center section of the display).

19. Set the air pressure to the Full Scale Input value (for example, 15 psig). Refer to “Input/Output Ports” section for pneumatic input specifications.

20. Wait at least 15 seconds, then press TAG/STORE pushbutton to lock-in the full scale value. Wait until 'CAL' in center display blinks - this indicates that the Full Scale value was stored successfully.

21. To verify calibration, proceed to step 22. Verification is always recommended. If verification is not desired, proceed to step 27.

22. Press ACK/STEP UP pushbutton to get back to PARAMETER level.

23. Push the UP/ARROW or DOWN/ARROW pushbutton to select the Verification parameter ('CVI1' for FB85, 'CVI2' for FB86, etc.). Parameter is shown on alphanumeric display.

24. Press ALARM/STEP DOWN pushbutton to enter VALUE level.

25. Set the air pressure to the Zero Input value. The center (numeric) section of the display should read 0.00% of input (tolerance: ±0.05%).

26. Set the air pressure to the Full Scale Input value. The center (numeric) section of the display should read 100.0% of input (tolerance: ±0.05%).

27. Select one of the following:

    If all pneumatic input function blocks have been calibrated and verified, press ENTER/EXIT CONF pushbutton to leave the calibration mode and enter operation mode.

    If additional function blocks are to be calibrated and verified, press ACK/STEP UP button twice to enter FUNCTION BLOCK level. Perform steps 10 through 26 for each function block to be calibrated and verified.

28. Having finished calibrating and verifying all the required function blocks, it is prudent to lock out the FIELDPAC's calibration mode via the MPU Controller Board's 'CAL' lockout switch (see “Lockout Switches” section).

4.9 I/P MODULE CALIBRATION (FB03)

The I/P Module in FIELDPAC is the same as the Model 773 I/PAC Transducer. To ensure continued accuracy of the I/P Transducer, it is suggested that the calibration be checked after the first thirty days of operation and then at six month intervals.

Function block 03 is used to configure and calibrate the I/P module. Because the I/P module replaces the current output in FB03, do not make any connections to terminals E11 and E12 when an I/P module is installed in a FIELDPAC.

Before proceeding with the calibration, refer to:

- “General Considerations” section for some general considerations
- Obtain the necessary equipment from the list given in “Required Equipment” section
- Enable the appropriate lockout switches described in “Lockout Switches” section
- Assign to FB82 a valid execution sequence number (ESN) as described in “ESN Assignment” section.

1. Verify FIELDPAC’s input power requirement. Apply power to the FIELDPAC. Allow the FIELDPAC to warm up for 1 hour prior to calibrating. The ambient temperature should be close to its expected operating temperature.

2. Ensure that the 'CAL' lockout switch is in the 'enabled' position. Refer to "Lockout Switches" section and Figure 5-3 to perform this task, if necessary.

3. Press ENTER/EXIT CONF pushbutton to enter FUNCTION BLOCK level.

4. Push the UP/ARROW or DOWN/ARROW pushbutton to select 'C' (calibration) on left digit position of alphanumeric display. (If 'CX' appears in the display, the lockout switch on the MPU Controller Board must be enabled, see "Lockout Switches" section).

5. Press ALARM/STEP DOWN pushbutton to enter FUNCTION BLOCK level.

6. Push the UP/ARROW or DOWN/ARROW pushbutton to select function block number 03 in the right side digits of the alphanumeric display.

7. Disconnect pneumatic tubing present at the output port.

8. Connect an appropriate test gauge to the output port.

9. Connect an air supply to the supply port, if none is connected.

10. Turn on the air supply and set the regulator to the required pressure for the Transducer's output range (see "Input/Output Ports" section for the required supply pressure).

11. Push ALARM/STEP DOWN pushbutton to enter PARAMETER level.

12. Push the UP/ARROW or DOWN/ARROW pushbutton to select parameter 'CZO1'. Parameter is indicated in the alphanumeric display.

13. Press ALARM/STEP DOWN pushbutton to enter VALUE level ('CAL' should appear in the center section of the display).

14. Press the UP/ARROW or DOWN/ARROW pushbutton to set zero output value on the test gauge (i.e. 3 PSI). If you cannot adjust the output enough with the UP or DOWN/ARROW keys, use the ZERO trimpot located on the I/P for more adjustment (Refer to Figure 4-2).

15. Wait at least 15 seconds, then press TAG/STORE pushbutton to lock-in desired value.

16. Press ACK/STEP UP pushbutton.

17. Push the UP/ARROW or DOWN/ARROW pushbutton ('CFO1' for full scale output).

18. Push the ALARM/STEP DOWN pushbutton to enter VALUE level ('CAL' should appear in the center section of the display).

19. Push the UP/ARROW or DOWN/ARROW pushbutton to set full scale output value on test gauge (i.e. 15 PSI). If you cannot adjust the output enough with the UP or DOWN/ARROW keys, use the SPAN trimpot located on the I/P module for more adjustment (Refer to Figure 4-2).

20. Wait at least 15 seconds, then press TAG/STORE pushbutton to store the desired value.

21. To verify calibration, proceed to step 22. Verification is always recommended. If verification is not desired, proceed to step 27.

22. Press ACK/STEP UP pushbutton to get back to PARAMTER level.

23. Push the UP/ARROW or DOWN/ARROW pushbutton to select verification parameter 'CVI1'. Parameter is shown on alphanumeric display.

24. Press ALARM/STEP DOWN pushbutton to enter VALUE level.

25. Push the UP/ARROW or DOWN/ARROW pushbutton to set 0.00%. The zero output value should be displayed on the test gauge.

26. Push the UP/ARROW or DOWN/ARROW pushbutton to set 100.00%. The full scale output value should be displayed on the test gauge.

27. Press ENTER/EXIT CONF pushbutton to leave the calibration mode and enter operation mode. Remember to lock-out calibration switch.

This completes the calibration and calibration verification procedure. If the verification results show that a recalibration is necessary, perform steps 1 through 7 again.

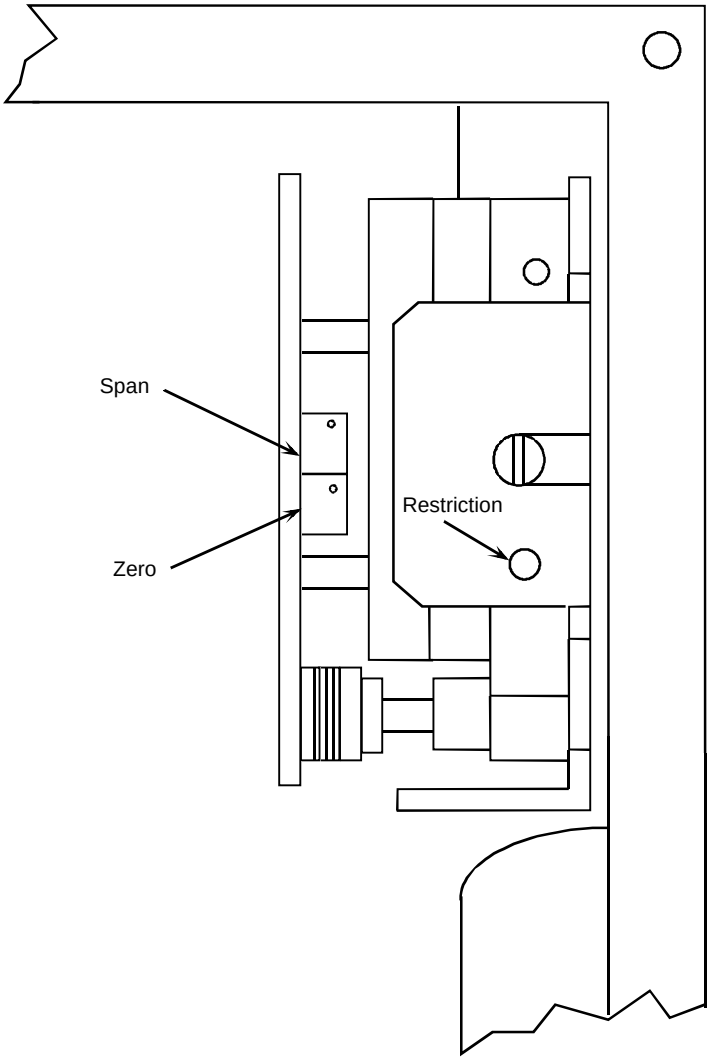

FIGURE 4-2 I/P Module

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5.0 CIRCUIT DESCRIPTION

The hardware architecture of the FIELDPAC is shown in Figure 5-1. Notice that all plug-in assemblies interact with the MPU Controller board.

The MPU Controller board oversees all of the FIELDPAC's internal operations. It interacts with the display/keyboard assembly and all the included options such as the temperature sensor board, the pneumatic input board, the I/P module, the pressure sensor, and the plug-in AC power supply. It also performs all of the FIELDPAC's built-in signal processing operations. The controller board's on-board DC power supply furnishes DC operating voltages to all plug-in assemblies and to external process transmitters connected to the terminal block.

The plug-in AC power supply is used for powering the FIELDPAC from nominal 120 or 240 Vac power lines. It converts a given AC line voltage to 24 Vdc which is the default power requirement of the MPU baseboard's on-board DC power supply.

The display/keyboard assembly provides LCD indication of process related signals, station operating mode, and configuration parameters. It also accepts operator entered commands and data via the Panel's front panel pushbuttons.

The temperature sensor board contains hardware which provides the interface circuitry to accept a thermocouple, an RTD sensor, or a millivolt input signal as configured.

The pneumatic input board contains hardware which provides the interface circuitry for one or three pneumatic input signals.

The I/P module contains the circuitry to convert a current signal (taken from the output of Analog Output #1) to a proportional pneumatic signal. This module plugs directly into the controller board (for power and input signal) and into an aluminum manifold (for air supply and pneumatic output).

A pressure sensor is attached to the rear of the FIELDPAC. Its electrical connections to the MPU controller board are made by a small ribbon cable and connector directly to the dedicated connector located on the upper left side of the controller board.

A functional description, a hardware block diagram and a physical layout drawing are provided for most of the following circuit areas:

- MPU Controller board
- Plug-In AC Power Supply
- Display/Keyboard Assembly
- Temperature Sensor Board
- Pneumatic Input Board
- I/P Module
- Pressure Sensor
- HART Signal Port

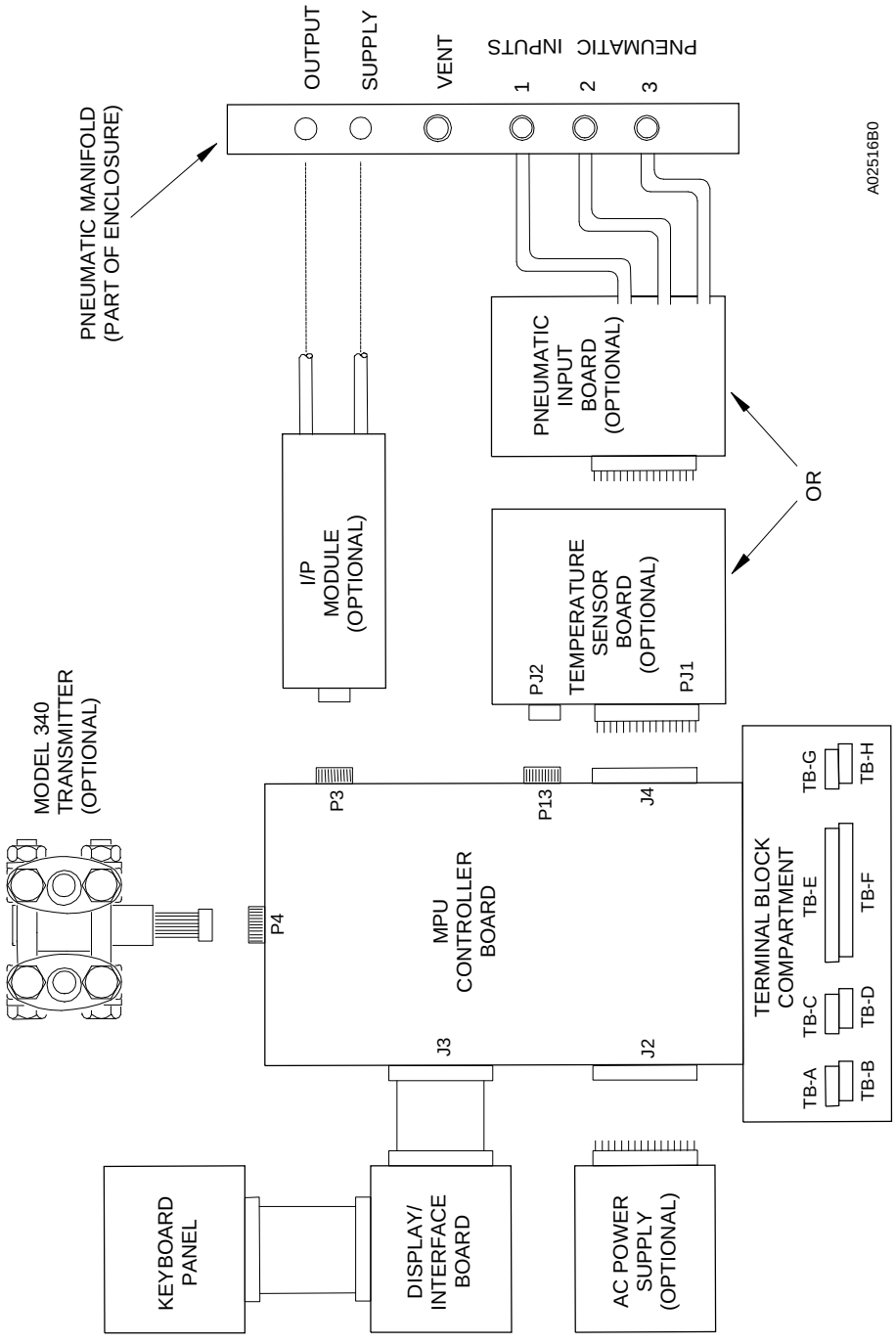


FIGURE 5-1 Model 348 Hardware Architecture

5.1 MPU CONTROLLER BOARD

The MPU Controller board's hardware is supported by a large array of software based function blocks. During station configuration, a group of function blocks are linked together to meet the control requirements of the station's application.

As shown in Figure 5-2, the MPU controller board has three analog inputs, two analog outputs, two digital inputs, two open-collector type digital outputs, two isolated digital outputs, an open-collector type pulse output, and a HART interface port. In addition, the MPU controller board can also accept the optional temperature sensor board or the pneumatic Input board (at J1), the I/P module (at P3), the pressure sensor (at P4), and the plug-in AC power supply (at J2). The display assembly is connected to the controller board via a ribbon cable at J3. Which inputs and outputs are active during station operation depends on which options are installed and how the FIELDPAC is configured. To determine the actual I/O arrangement, refer to the appropriate configuration documentation.

The MPU controller board contains both analog and digital circuits. Analog circuitry operates in real time, the microprocessor-based digital circuitry operates at high speed under program control. Figure 5-3 shows the physical layout of the MPU controller board.

The MPU (microprocessor unit) is a single integrated circuit capable of arithmetical, logical, and support circuit control functions. It directly or indirectly interacts with surrounding on-board and off-board circuitry to control the internal operation of the FIELDPAC. To operate under program control, the MPU systematically fetches instructions from the PROM area and executes them to control data flow and organize support circuit activities.

The Clock circuit contains a precision square wave oscillator which operates at 7.3728 MHz. It also contains several flip-flop type of frequency dividers to down count the oscillator frequency to values required by the MPU and other digital circuits. Timing pulses from the Clock are used to synchronize the MPU's computing activities.

On-board memory consists of PROM (programmable read only memory) and NVRAM (non-volatile random access memory). The PROM stores the operating programs for the function blocks and Factory Configured Options (FCOs) associated with a Model 348. It also stores the general operating programs for the on-board microprocessor. The NVRAM stores hard configuration, the table of function blocks, soft configuration, calibration data, and transient data.

During configuration and calibration, data is entered into NVRAM when the TAG/STORE button is pressed. Transient data (process, station status, alarm, and error code data) is also stored in NVRAM.

The MPU's three bus lines are the address bus, the data bus, and the control bus. They interconnect the MPU, the NVRAM, the PROM, and other support circuits. The address bus is unidirectional while the control and data buses are bidirectional.

The Signal Selector circuit operates under MPU control to sequentially select one of the three analog signals and feed it to the A/D Converter. It is essentially a solid state switch that repeatedly scans the three analog inputs.

The A/D Converter circuit converts the selected analog input signal into a digital value. Once digitized, the signal value can easily be manipulated and stored in memory by the MPU.

The D/A Converter circuit converts a digital value into an analog signal.

The Amplifier circuit provides gain and drive capability to the analog signal output of the D/A Converter.

The Opto-Coupler circuit provides signal isolation for the digital input signal.

The built-in DC power supply accepts a nominal 24 Vdc power input and provides +10, -10, and +5 voltage levels needed by the FIELDPAC's analog and digital circuitry. The Model 348E FIELDPAC can also be equipped with an additional plug-in AC power supply that will accept a nominal 120 or 240 Vac power input and convert it to 24 Vdc for input to the built-in DC power supply.

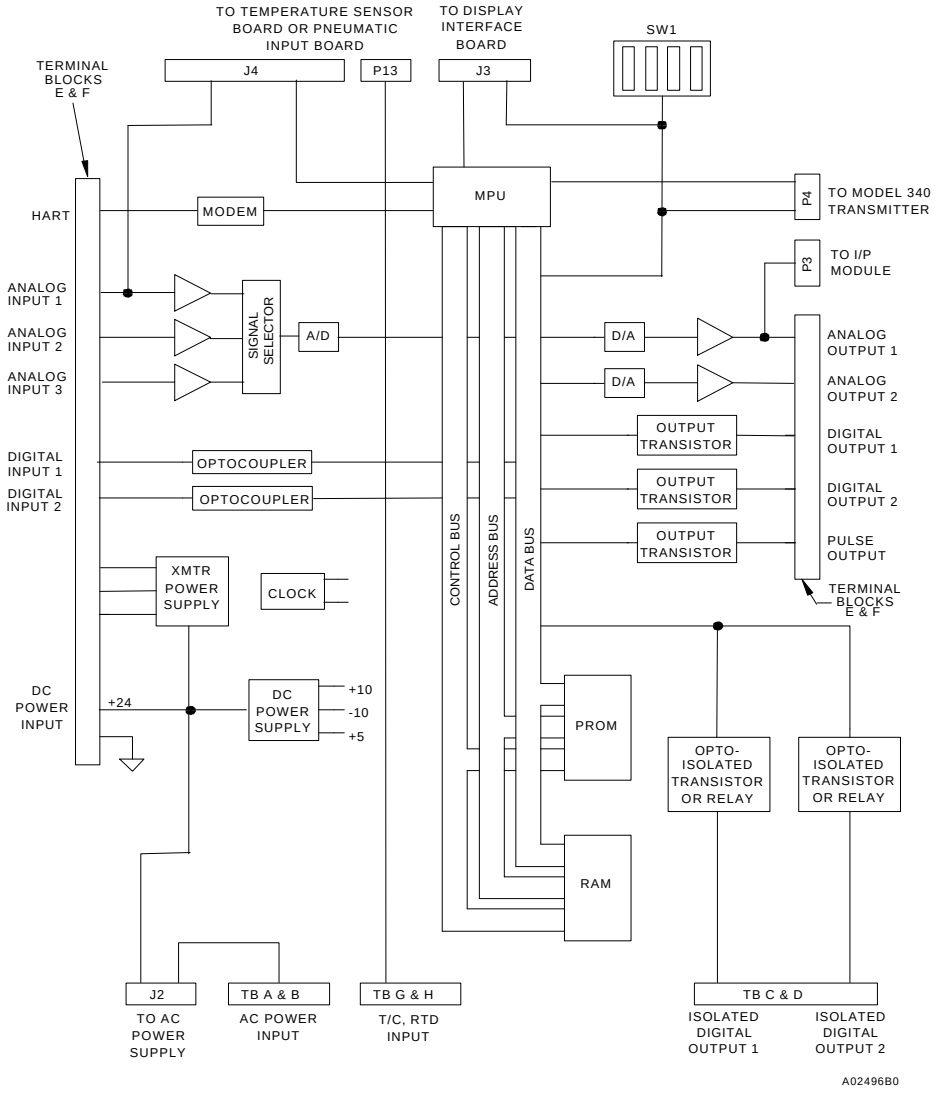


FIGURE 5-2 MPU Controller board Inputs and Outputs

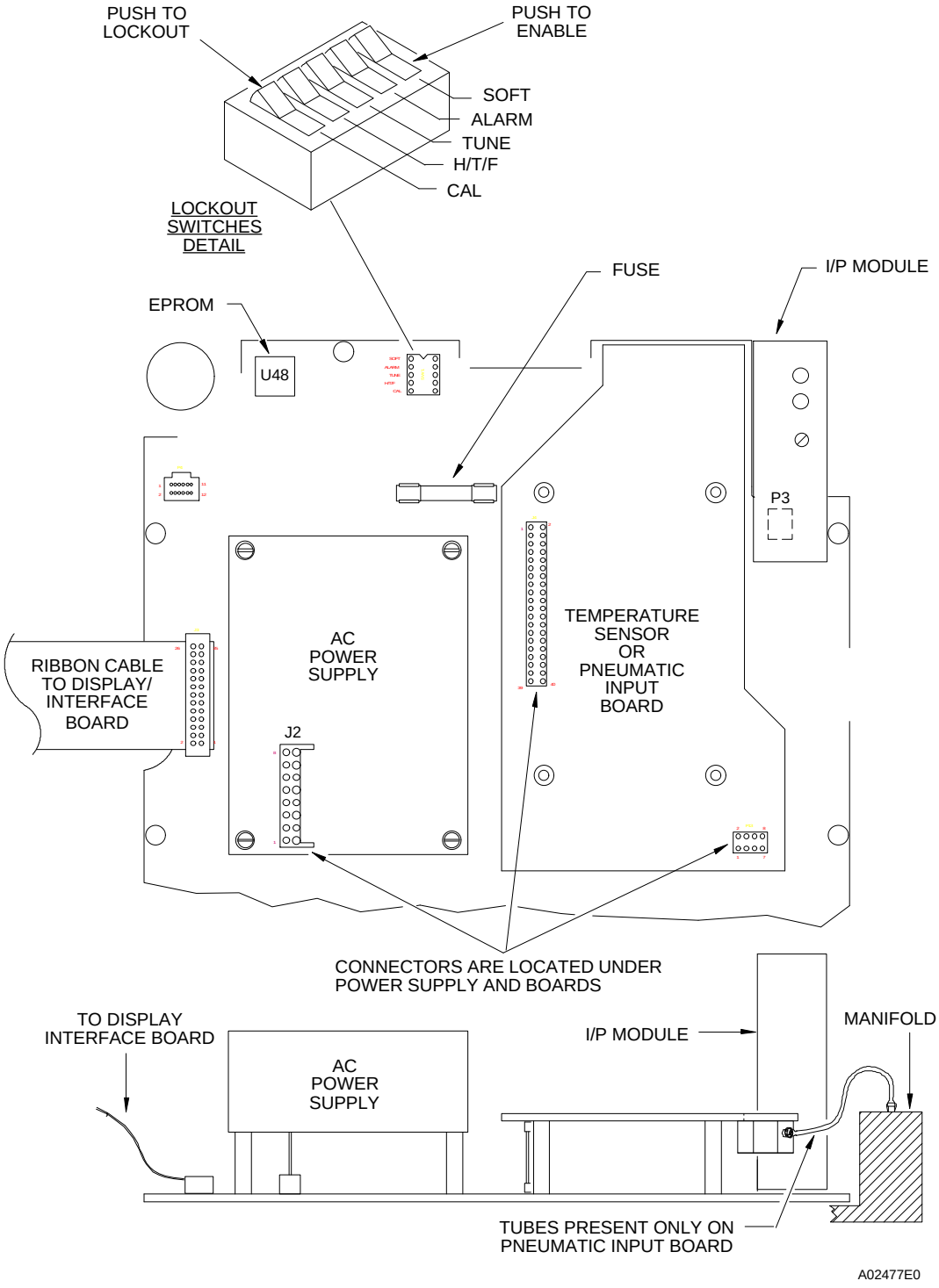


FIGURE 5-3 MPU Controller board Physical Layout

The transmitter power supply regulator also accepts the +24 Vdc and provides a nominal +22 Vdc output at the terminal block to power two-wire transmitters or other devices.

The reference voltage circuitry provides precision analog reference voltages of +5, -5, and +2.5 for the A/D and D/A converters and other analog circuits.

Lock out switches are located at the top center of the controller board and can be set to prevent unauthorized changes to selected configuration modes.

The station power fuse is located at the center top of the board.

5.2 PLUG-IN AC POWER SUPPLY

The plug-in AC power supply is used for powering the FIELDPAC from nominal 120 or 240 Vac power lines. It converts a given ac line voltage to 24 Vdc which is the default power requirement of the MPU baseboard's on-board DC power supply. It uses a 1 A fuse (P/N 7447-209) for circuit protection.

5.3 DISPLAY/KEYBOARD ASSEMBLY

The display/keyboard assembly is installed in the top cover of the FIELDPAC enclosure. It consists of the following components:

- Display/Interface Board
- Keyboard

The display/keyboard assembly functions under the direction of the MPU located on the controller board. It provides LCD indication (both analog and digital) of various process signals, accepts operator entered data during hard and soft configuration and calibration procedures, and supports the front panel operator controls.

5.3.1 Display/Interface Board

The display/interface board performs several functions. It interfaces the whole display/keyboard assembly to the MPU controller board and provides the electronic circuitry to operate the LCD panel and the keyboard. It scans the keyboard for operator initiated keystrokes and forwards display data to the LCD panel.

The pulses generated by the UP ARROW and DOWN ARROW pushbuttons are counted by the digital up-down counter which places binary pulse counts on the data bus where they can be retrieved and used by the MPU controller board to adjust process signals (e.g., setpoint or valve) or adjust configuration selections.

The keyboard scanner circuit has a built-in oscillator and scans the keyboard at regular time intervals to sense a complete keystroke. If a keystroke is detected, data identifying that key is placed on the data bus where it can be interpreted by the MPU of the controller board.

The segment and digit driver circuitry uses standard digital decoding and latching techniques. The display driver circuit performs two main functions. It decodes display data received from the MPU controller board and forwards decoded display data to the LCD panel. Refer to “Operation” section for description of each display's purpose.

5.3.2 Keyboard

The keyboard is a membrane keypad which contains eleven switches. The layout of these switches is shown in Figure 3-1. Each switch has tactile feel. Operator initiated keystrokes are sensed by circuitry on the display/interface board. The keyboard has a built-in shield to prevent false triggering from static or EMI (electromagnetic interference). A flex-circuit ribbon cable connects the keyboard to the display/interface board.

5.4 TEMPERATURE SENSOR BOARD

The temperature sensor board can be configured to accept a variety of thermocouple types, various millivolt sources, and several different RTD types. Refer to “Input/output Ports” section for detailed input specifications.

The temperature sensor board plugs into the MPU controller board via two connectors as shown in Figure 5-1, Hardware Architecture. Connector PJ2 on the sensor board carries the input signals and PJ1 accommodates power, control, and data lines.

Figure 5-4 shows a block diagram of the temperature sensor board. The circuitry on the sensor board is powered by the controller board. The input stages are powered by an on-board isolated bipolar 5V power supply (Isolated DC-DC Converter).

The thermocouple or millivolt input signal appears at the overvoltage protection and open T/C detection stage. The components in this stage function as transient suppressors and protect the input circuitry from accidental application of excessive plus or minus voltages. A constant current source is provided for RTD use. An automatic cold junction compensation circuit is switched in for thermocouple inputs.

The amplified and filtered analog signal representing the thermocouple or millivolt signal appears at the input to the A/D converter. The converter produces a digital output consisting of a train of pulses whose count is proportional to the amplitude of the analog input. This output is routed through the isolation transformers to the interface circuitry. The MPU retrieves this data for further processing. It performs the following functions:

- Linearization
- Calibration
- Filtering
- Output Scaling

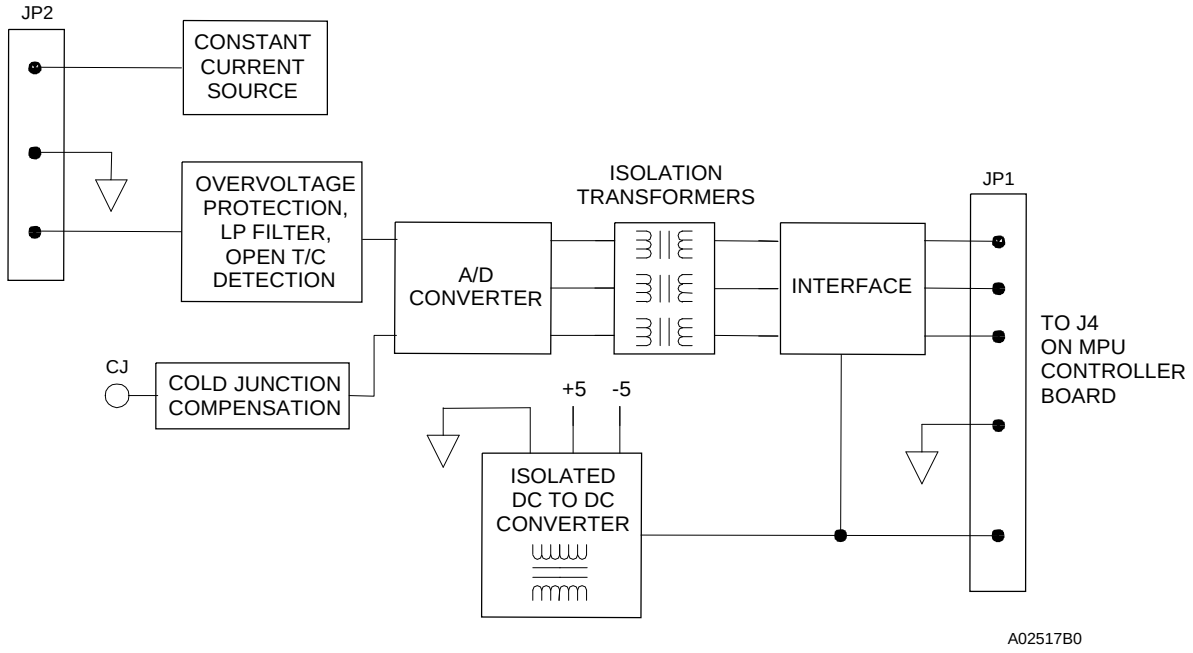


FIGURE 5-4 Temperature Sensor Board Block Diagram

5.5 PNEUMATIC INPUT BOARD

The pneumatic input board can be configured to accept one or three pneumatic input signals, depending on the board installed. Refer to “Input/Output Ports” section for detailed pneumatic input specifications.

The board plugs into the MPU controller board via one connector as shown in Figure 5-1, Hardware Architecture. This connector carries the output signal and accommodates power and control lines. Flexible tubing is used to connect the pneumatic input port manifold to the pressure transducers on the Board.

Figure 5-5 shows a block diagram of the pneumatic input board. The circuitry on the board is powered by the controller board.

The pneumatic input signals are brought in individually via the flexible tubing to their respective pressure transducers. Three constant current sources provide the necessary current to the transducers. Signals from the transducers are fed via individual gain stages to the signal selector.

The signal selector circuit operates under MPU control to sequentially select one of the three signals and feed it to Analog Input 1. Note that to be able to configure pneumatic inputs for use, it is necessary that Analog Input 1 be assigned an ESN of 00 (zero).

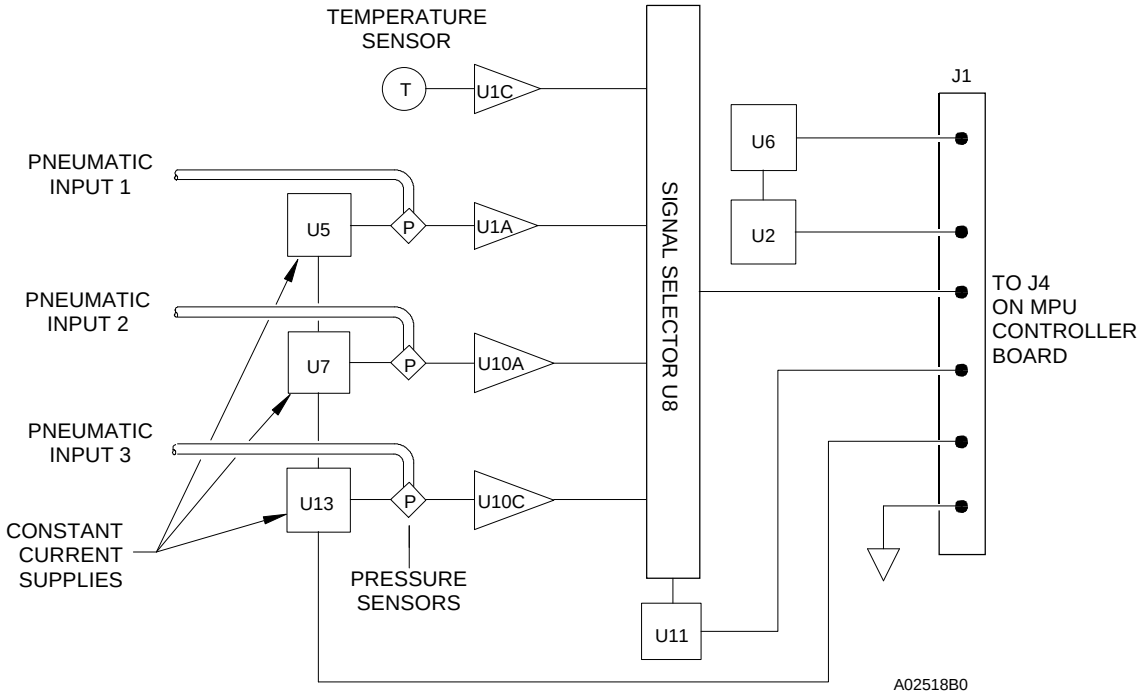


FIGURE 5-5 Pneumatic Input Board

5.6 I/P MODULE

The I/P transducer module consists of an electronic controller and a pneumatic booster unit. It is essentially a Model 773D Current to Pneumatic Transducer without its enclosure. Figure 5-6 shows a simplified circuit diagram of the transducer module.

A setpoint milliamp signal from analog output #1 on the MPU controller board and a process variable pneumatic feedback signal from the booster unit are supplied to the electronic controller. The controller compares these inputs and provides an electrical signal to a coil-driven pneumatic flapper/nozzle assembly. The pneumatic signal from this assembly is routed to the booster unit which adjusts the transducer module pneumatic output in a direction to track the setpoint signal.

5.7 PRESSURE SENSOR

The pressure sensor used with the FIELDPAC is essentially a Model Series 340 Pressure Transmitter without its electronics module and housing. It uses the built-in circuitry in the FIELDPAC for all the required signal processing.

5.8 HART SIGNAL PORT

The HART circuitry resides on the MPU controller board (see Figure 5-2). The bi-directional HART digital circuit consists of a 500 Hz to 10 kHz bandpass filter, and a half-duplex modem. The HART protocol uses 1.2 and 2.2 kHz tones to communicate between devices.

Typically, an arriving HART signal is passed through the bandpass filter and fed to the modem. The modem demodulates the tones and feeds the resultant signal to the MPU.

Conversely, an outgoing HART signal is initiated by the MPU by sending data to the modem. The modem generates a corresponding two-tone HART protocol signal which is passed back on the line. A remote HART device then receives the two-tone signal and processes it as needed.

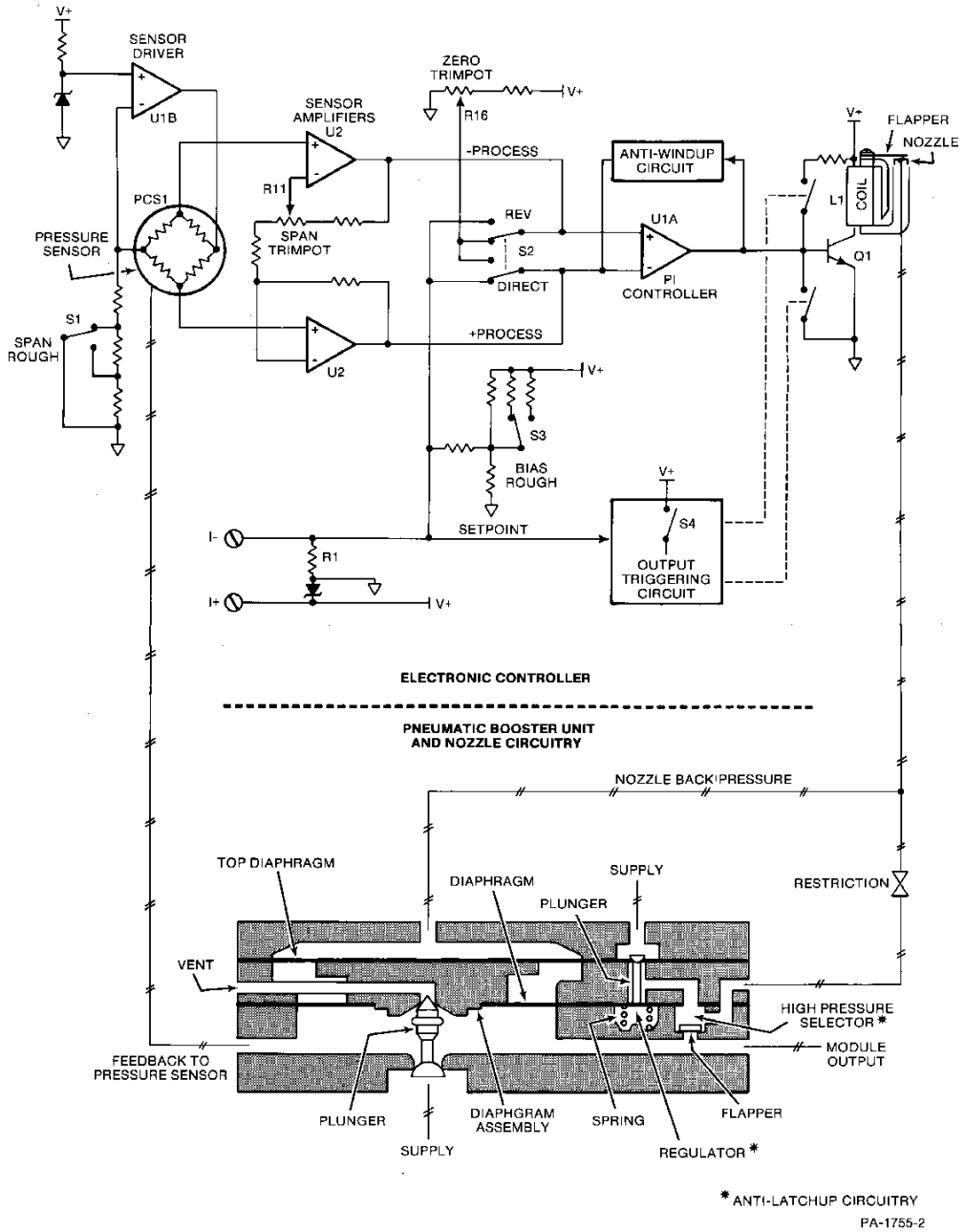


FIGURE 5-6 Transducer Module Circuit Diagram

6.0 MAINTENANCE

The Field Mounted Controller's (FIELDPAC's) maintenance requirements are minimal. Activities such as cleaning and visual inspection should be performed at regular intervals. The severity of the FIELDPAC's operating environment will determine the frequency of maintenance. Additional topics including troubleshooting, assembly replacement, and software compatibility are also covered.

6.1 TOOL AND EQUIPMENT REQUIREMENTS

The following tools and equipment are necessary for servicing:

A. Common electronic hand tools

B. Digital Multimeter (DMM)
   Voltmeter section
      Accuracy ..... +/-0.01% of reading
      Resolution ..... 1.0 millivolt
      Input impedance ..... 10 Megohms

   Ammeter section
      Accuracy ..... +/-0.1% of reading
      Resolution ..... 100 microamperes

C. Maintenance Kit, P/N 15545-110, containing wrist strap and conductive mat. This kit, or an equivalent, is required when a circuit board is handled for any reason.

6.2 PREVENTIVE MAINTENANCE

The objective for establishing a preventive maintenance program is to provide maximum operating efficiency. Every preventive maintenance operation should assist in realizing this objective. Unless a preventive measure reduces a Station's down time, it is unnecessary.

6.2.1 Environmental Considerations

The FIELDPAC has been designed to operate within specified environmental parameters (temperature and humidity). These parameters are listed in the “Specification” section of this Instruction. Additional information concerning environmental contaminants is presented in the Installation section.

6.2.2 Visual Inspection

As part of a periodic maintenance program the FIELDPAC must be visually inspected. When viewing the assembly, scan for abnormalities such as loose, broken or stressed ribbon cables. Look for damaged circuitry and

heat stressed parts. Check for excessive dirt or dust build-up which may impede air flow and inhibit proper heat dissipation.

6.2.3 Cleaning

Circuit boards should not be cleaned unless accumulated foreign material is causing a problem. The enclosed station design should prevent particulate material from building up. If cleaning becomes necessary, remove debris with either a soft brush or low velocity deionized air.

The bezel is cleaned with a mild, nonabrasive liquid cleaner and a soft, lint-free cloth. Do not use a paper towel.

6.2.4 Circuit Board Handling

Special handling procedures are required whenever a circuit board assembly is removed, tested, repaired, adjusted or installed in the Station's case. These procedures are required to prevent component damage from the electrostatic discharge hazard to which most semiconductors are vulnerable. When handling an assembly, follow the procedures outlined in the “Assembly Replacement” section of this Instruction.

6.3 FUSE LOCATION

A power input fuse is located at the top center of the MPU baseboard. This is the FIELDPAC's main power fuse. A replacement fuse may be obtained from any local electronics supplier or may be ordered from the factory. See the FIELDPAC Parts List, in the back of this manual, for fuse part number and description.

After inserting a new fuse and assembling the station, apply power. Operate the station off-line for several minutes to be sure that a condition does not exist which will cause the replacement fuse to fail.

The plug-in AC power supply is equipped with its own fuse. This fuse can be replaced easily only when the power supply is removed from the FIELDPAC. Refer to “AC Power Supply” section for instructions to remove the power supply, and the “FIELDPAC Parts List”, in the back of this manual, for fuse part number and description.

6.4 TROUBLESHOOTING

If a problem develops upon initial installation, check the following:

- Station's nameplate for input power requirements and installed options - refer to “Introduction” section
- Installation wiring - refer to “Installation” section
- Station's hard and soft configuration parameters - refer to “Function Block Description” section
- Wiring of any associated external devices such as process transmitters - refer to “Installation” section

Field servicing experience indicates that most initial service incidents involve one or more of the above items.

Error codes appear on the alphanumeric display in response to a failed power-up diagnostic test or to an on-line station error (see “Error Codes” section).

In the event that a malfunction within the FIELDPAC is suspected, trouble shooting by assembly substitution is recommended to get the station back on-line in the shortest possible time. The plug-in design of the station assemblies permits rapid removal and replacement to isolate a defect.

NOTE

When replacing an MPU controller board, all of the station's configuration and calibration parameters must be reentered. Factory repaired stations must be configured before being placed on-line. Refer to the configuration and calibration sections of this instruction.

Additional troubleshooting avenues are also possible. For example, a series of test configurations may be generated and implemented to exercise different function block areas within the FIELDPAC. This type of troubleshooting analysis is intended to be implemented in an off-line test bench situation.

6.4.1 Error Codes

The FIELDPAC will display one or more error codes in response to a failure during the power-up diagnostic test or during its on-line operation.

Power-Up Error Codes

The error codes in Table 6-1 will appear on the alphanumeric display if a failure is encountered during the power-up diagnostic test.

TABLE 6-1 Power-Up Error Codes

ERROR CODE	DIAGNOSTIC TEST	PROBLEM CONFIRMATION	CORRECTIVE ACTION
E110	RAM - Verifies that each memory location can be written to and read from	Remove and reapply station power.	Power down 348 and make sure NVRAM chip and microcontroller chip are properly seated in sockets.
E111	ROM CHECKSUM - Verifies factory entered data	Remove and reapply station power.	Power down 348 and make sure ROM chip and microcontroller are properly seated in sockets.
E214	Verifies transient data	Remove and reapply station power.	Press ENTER/EXIT CONF button. The station loads default transient data and enters normal mode. Verify configuration and re-enter if necessary. This error may lead to an E215 error as discussed below.
E215	Verifies Configuration and Calibration Data	Remove and reapply station power.	Press ENTER/EXIT CONF button. The station defaults configuration and calibration data. Reconfigure and recalibrate all inputs and outputs.
E216	FB81 is active but there is no 340 capsule	Remove and reapply station power.	Install option or press ENTER/EXIT CONF button to remove FB from ESN table.
E226	FB82 is active but there is no temperature input board	Remove and reapply station power.	Install option or press ENTER/EXIT CONF button to remove FB from ESN table.
E236	FB85/86/87 is active but there is no pneumatic input board	Remove and reapply station power.	Install option or press ENTER/EXIT CONF button to remove FB from ESN table.

On-Line Error Codes

The error codes in Table 6-2 will appear on the alphanumeric display if a failure is encountered during the FIELDPAC's on-line operation.

TABLE 6-2 On-Line Error Codes

ERROR CODE	DEFINITION	PROBLEM CONFIRMATION	CORRECTIVE ACTION
E1	MPU Board A/D Error	Remove and reapply station power.	Replace MPU board.
E2	340 Capsule A/D Error	Remove and reapply station power.	Verify that the flex cable from 340 pressure sensor is properly and fully inserted into mating connector on MPU board. Check for visible damage. Power cycle the 348 to see if it occurs again. Problem may either be sensor assembly or MPU board. Replace either board to determine which board it is or contact Moore Products Co. for service or replacement.
E3	Temperature Input A/D Error	Remove and reapply station power.	Verify the temperature input board is properly and fully inserted into MPU board connectors. Check for damaged or misaligned pins. Problem may either be temperature board or MPU board. Replace either board to determine which board it is or contact Moore Products Co. for service or replacement.

6.5 ASSEMBLY REPLACEMENT

As is the case with most electronic assemblies populated with semiconductor components, precautions must be observed to prevent component damage from ESD (i.e., electrostatic discharge). Accordingly, a maintenance kit containing a wrist strap and a conductive mat must be used whenever an assembly, such as the display/keyboard panel, is removed from or installed in the station case.

Whenever an assembly is not installed in a station, it must be stored in a static shielding bag. These bags are 8" x 12" (20.3cm x 45.7cm) and are available from the factory under material code X6080. The MPU controller board requires a larger bag.

When unplugging ribbon cable from an assembly be sure to grip the connector, not the ribbon wire. Care should be exercised when seating and unseating circuit boards.

Station calibration must be verified and if necessary calibrated after replacing any of the following plug-in circuit boards or modules:

- MPU Controller Board
- Pneumatic Input Board
- Process Pressure Input Transducer
- I/P Module (recommended)

6.5.1 Upper Door Assembly

The upper door assembly uses 2 metal hinges and 4 captive screws to attach to the enclosure (refer to Figure 6-1). Earlier versions of the upper door assembly used plastic molded hinges instead of metal hinges.

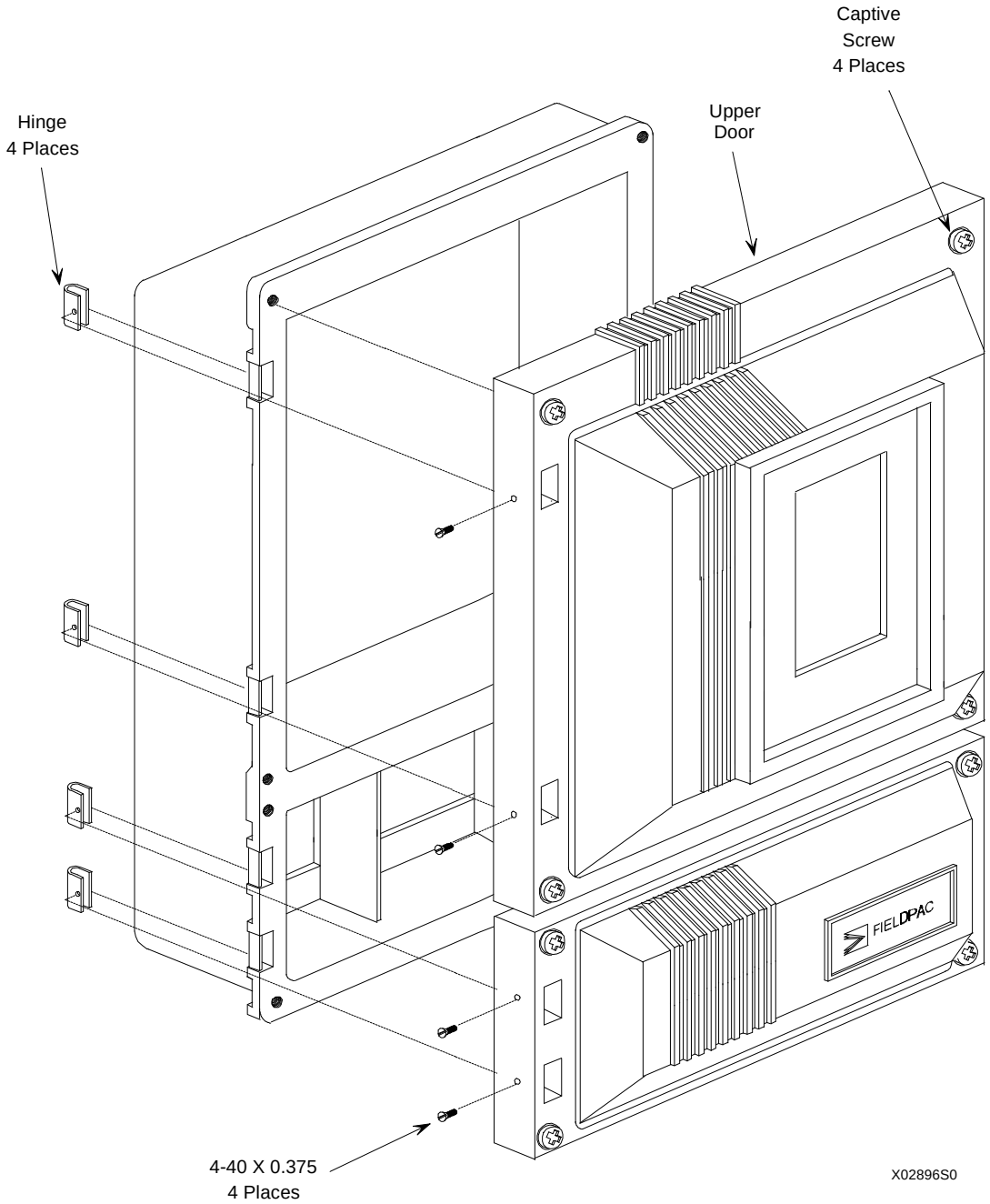


FIGURE 6-1 Upper Door and Terminal Compartment Cover

REMOVAL:

1. Loosen the captive screw at each corner of the upper door and swing the door open.

2. Place a conductive wrist strap on your wrist and ground the strap to the controller casting to prevent electrostatic discharge from damaging an electrical component.

3. Refer to Figure 6-2 and disconnect the multi-color ribbon cable by opening the eject levers and carefully pulling the connector from the display interface board.

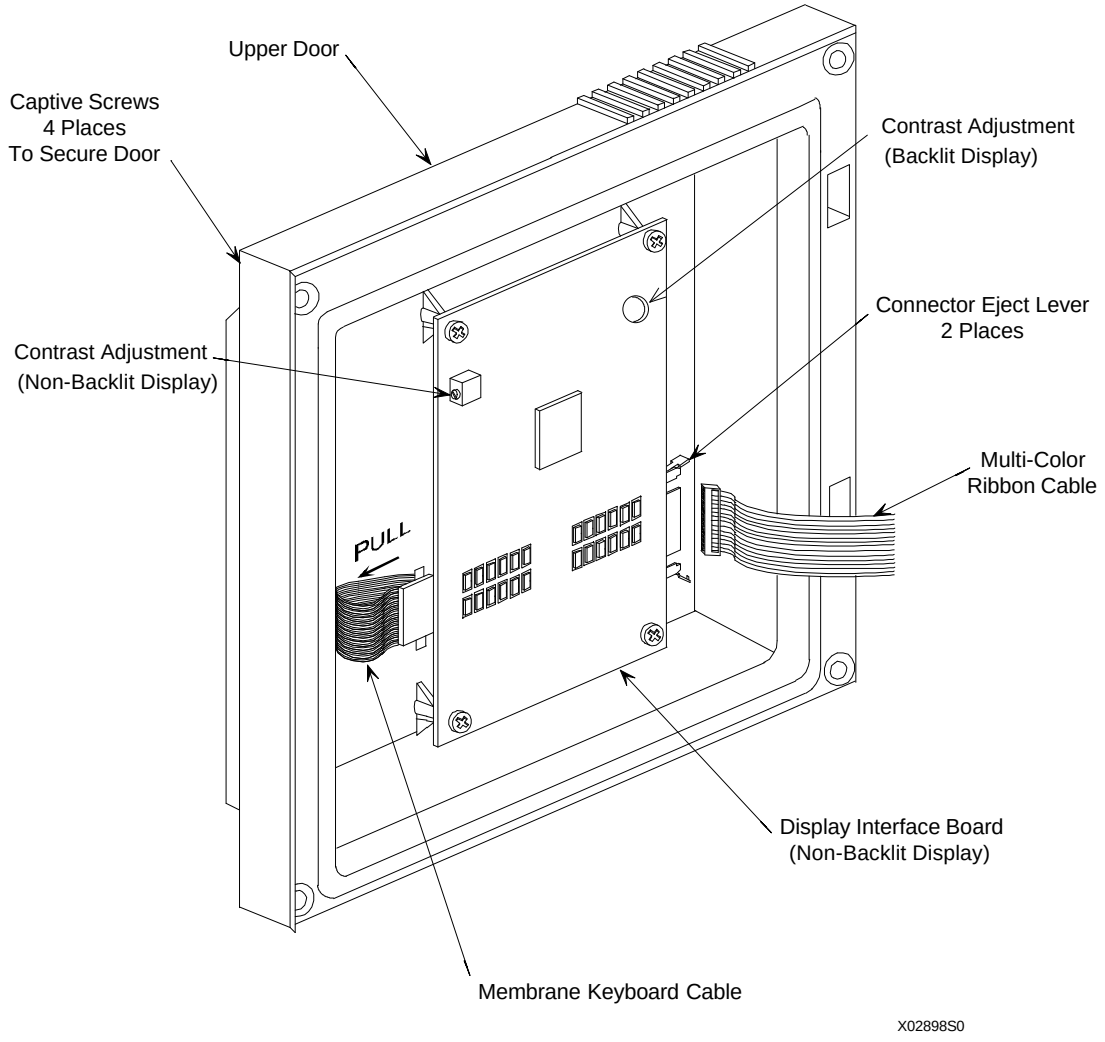


FIGURE 6-2 Upper Door Assembly

4. Refer to Figure 6-2 and disconnect the membrane keyboard flexible-circuit ribbon cable from the display interface board by carefully pulling the black connector from the display interface board.

5. Refer to Step A if door has metal hinges or Step B if door has molded hinges.

   A. Remove the screws from the 2 metal hinges and take the door off.

   B. Hold the controller in place and remove the upper door by continuing the door opening motion

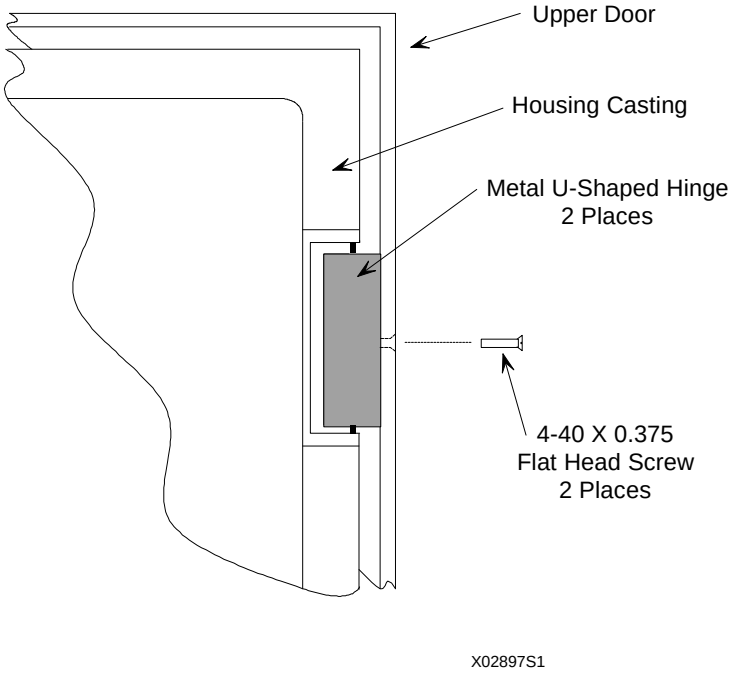


FIGURE 6-3 Rear View of Hinge Assembly

HINGE INSTALLATION:

1. Ensure the wrist strap is connected to the ground screw on the right side of the FIELDPAC enclosure.

2. Place the new door in its closed position over the housing casting and gently tighten the four captive screws.

3. Refer to Figures 6-1 and 6-3, and insert a hinge into the back edge of the door at the top rectangular opening. Align the threaded hole in the hinge with the countersunk hole in the side of the door and insert a #4 flat head screw. Gently tighten the screw -- do not over tighten to avoid stripping hinge threads.

4. At the lower rectangular cutout in the door, insert and fasten the second hinge. Loosen the four captive screws securing the door. The door should now open and close freely.

5. If the display interface board removed above is to be installed, fasten it to the inside of the door using the original four screws. Be sure that the membrane keyboard ribbon cable connector extends to the left of the board, as it did with the original door.

6. Connect the membrane Keyboard cable and the multi-colored ribbon cable to the display interface board.

7. Close the door and gently tighten the four captive screws. Remove the wrist strap.

6.5.2 TERMINAL COMPARTMENT COVER

To replace the Terminal Compartment Cover use the following procedure:

REMOVAL:

1. Open the terminal compartment cover by unscrewing the four 10-32 x 5/8" captive screws and swinging it open on its left hinges.

2. Refer to Figure 6-1 and carefully remove the two #4 screws from the hinges while holding on to the door..

3. Discard the defective cover.

INSTALLATION:

1. Remove the new terminal compartment cover from its shipping container. Place new cover in its closed position over terminal board area of housing and gently tighten the four captive screws.

2. Refer to Figures 6-1 and 6-3 and insert a hinge into the back edge of the cover at the top rectangular opening. Align the threaded hole in the hinge with the countersunk hole in the side of the cover and insert a #4 flat head screw. Gently tighten the screw -- do not over tighten to avoid stripping the hinge threads.

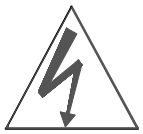
3. At the lower rectangular cutout in the cover, insert and fasten the second hinge. Loosen the four captive screws securing the cover to the housing. The cover should open and close freely.

6.5.3 AC Power Supply

To replace or install the AC power supply, refer to Figure 6-4 and use the following procedure:

REMOVAL:

1. Turn OFF power to the FIELDPAC.



WARNING

Electrical shock hazard - Remove power from the FIELDPAC before removing the AC power supply.

2. Connect a wrist strap to the ground screw on the right side of the FIELDPAC enclosure.

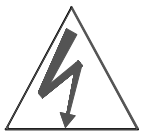
3. Open the display/keyboard cover assembly by unscrewing the four 10-32 x 5/8" captive screws and swinging it open to the left on its hinges.

4. Remove the four 4-40 x 1.5" screws that secure the AC power supply to the four stand-offs on the MPU controller board.

5. Unplug the defective AC power supply module from its mating connector on the MPU controller board.

INSTALLATION:

1. Ensure power is OFF at the FIELDPAC and wrist strap is connected to the ground screw on right side of FIELDPAC enclosure.



WARNING

Electrical shock hazard - Remove power from the FIELDPAC before installing the AC power supply.

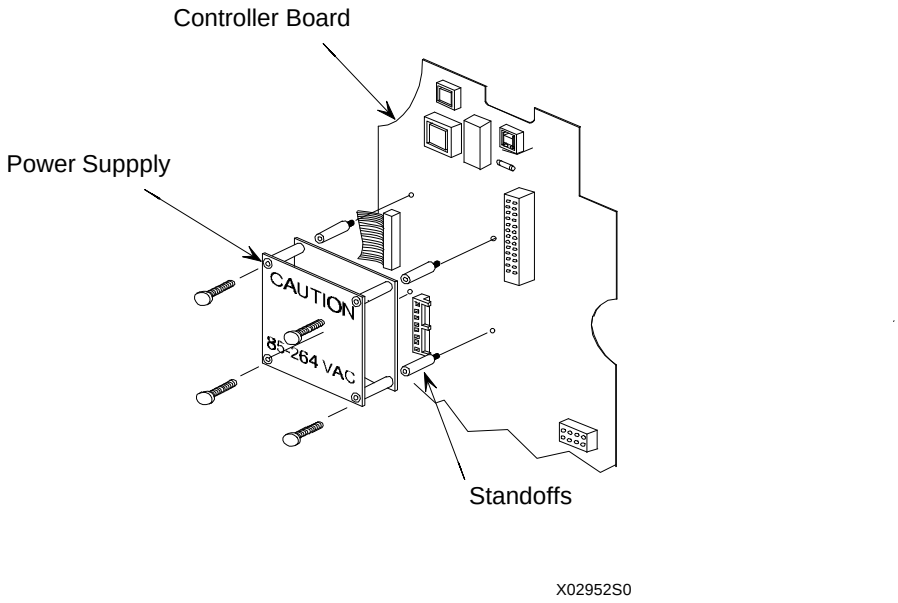


FIGURE 6-4 Power Supply Removal/Installation

2. Remove the new AC power supply module from its static shielding bag.

3. Check the presence and security of the four 1" stand-offs on the MPU controller board. If necessary, install and/or tighten the stand-offs.

4. Line up the connector pins of the new AC power supply with the mating connector on the MPU controller board and push the power supply against the MPU controller board until the connector pins are properly engaged and the Power Supply rests on the 1" stand-offs.

5. Insert the four 4-40 x 1.5" screws into the appropriate holes in the power supply and secure it to the four stand-offs.

6.5.4 Temperature Sensor Board

To replace or install the temperature sensor board, refer to Figure 6-5 and use the following procedure:

REMOVAL:

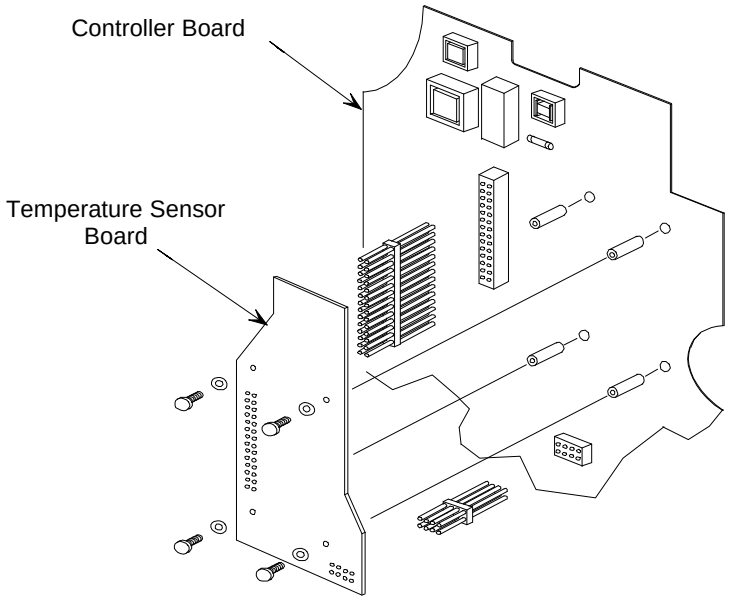
1. Remove power from the FIELDPAC.

2. Connect a wrist strap to the ground screw on the right side of the FIELDPAC enclosure.

3. Open the display/keyboard cover Assembly by unscrewing the four 10-32 x 5/8" captive screws and swinging it open on its left hinges.

4. Remove the four 4-40 x 0.25" screws and associated flat washers that secure the temperature sensor board to the four standoffs on the MPU controller board.

5. Unplug the defective temperature sensor board from its mating connectors on the MPU controller board.



Temperature Sensor Board Installation

X02951S0

FIGURE 6-5 Temperature Sensor Board Removal/Installation

INSTALLATION:

1. Ensure power is OFF at the FIELDPAC and wrist strap is connected to the ground screw on right side of FIELDPAC enclosure.

2. Remove the new temperature sensor board from its static shielding bag.

3. Check the presence and security of the four 1" standoffs on the MPU controller board. If necessary, install and/or tighten the standoffs.

4. Line up the connector pins of the temperature sensor board with the mating connectors on the MPU controller board and push the temperature sensor board against the MPU controller board until both connectors are properly engaged and the board rests on the 1" standoffs.

5. Insert four 4-40 x 0.25" screws (with flat washers) into holes in the temperature sensor board and secure to the four standoffs.

6.5.5 Pneumatic Input Board

To replace or install a pneumatic input board, refer to Figure 6-6 and use the following procedure:

REMOVAL:

1. Remove power from the FIELDPAC.

2. Connect a wrist strap to the ground screw on the right side of the FIELDPAC enclosure.

3. Open the display/keyboard cover Assembly by unscrewing the four 10-32 x 5/8" captive screws and swinging it open on its left hinges.

4. Remove the four 4-40 x 0.25" screws and associated flat washers that secure the pneumatic input board to the four standoffs on the MPU controller board.

5. Disconnect the pneumatic tubing from the manifold.

6. Unplug the defective pneumatic input board from its mating connector on the MPU controller board.

INSTALLATION:

1. Ensure power is OFF at the FIELDPAC and wrist strap is connected to the ground screw on right side of FIELDPAC enclosure.

2. Remove the new pneumatic input board from its static shielding bag.

3. Check the presence and security of the four 1" standoffs on the MPU controller board. If necessary, install and/or tighten the stand-offs.

4. Line up the connector pins of the pneumatic input board with the mating connector on the MPU controller board and push in the pneumatic input board until it rests on the 1" standoffs.

5. Insert the four #4-40 x 0.25" screws into the appropriate holes in the pneumatic input board and secure it to the four stand-offs.

6. Check to see that a valve body (P/N 16161-80) is installed in the enclosure manifold for each pneumatic input used (one or three). If this is a replacement installation, a valve body will already be in place for each input. In upgrade installations, a valve body must be installed (using non-permanent Loctite) for each needed input.

7. Connect the pneumatic tubing originating at the pneumatic input board to the corresponding pneumatic connection(s) at the enclosure manifold.

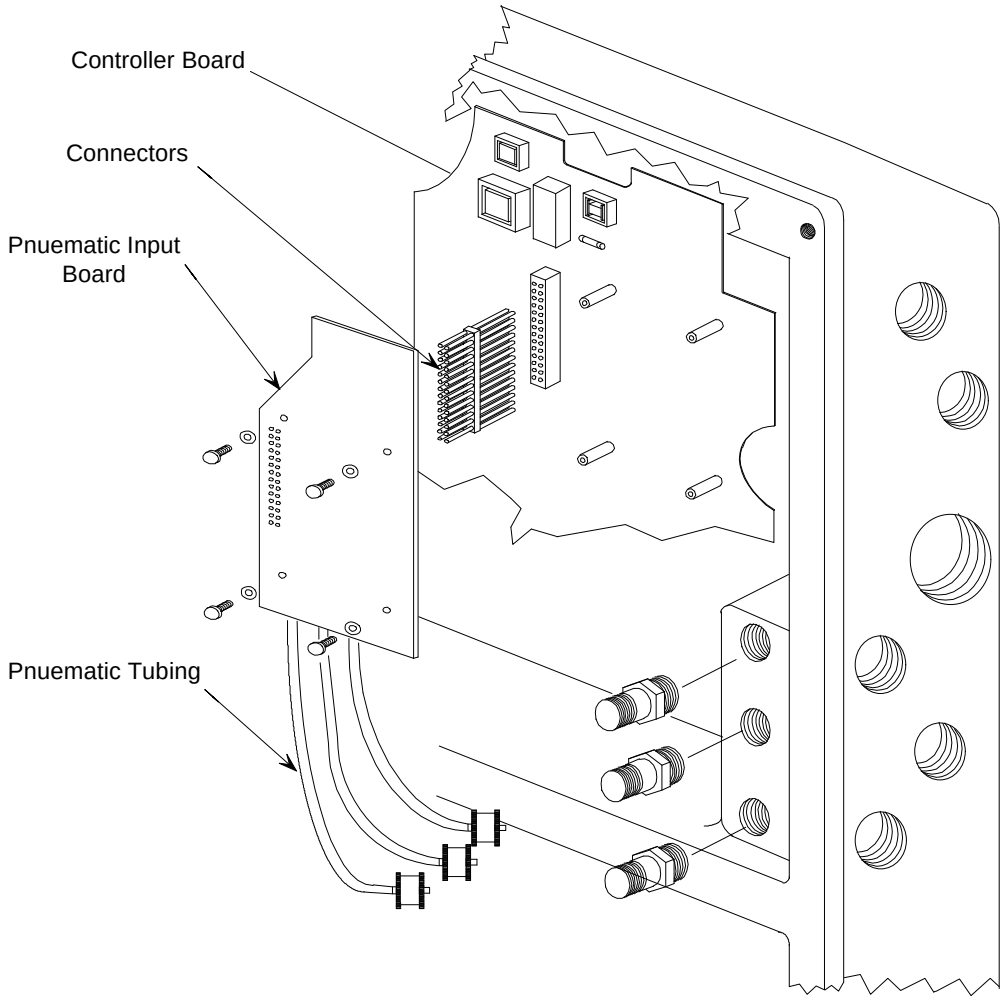


FIGURE 6-6 Pneumatic Input Board

6.5.6 Pneumatic Output Board

To replace or install the pneumatic output board, refer to Figure 6-7 and use the following procedure:

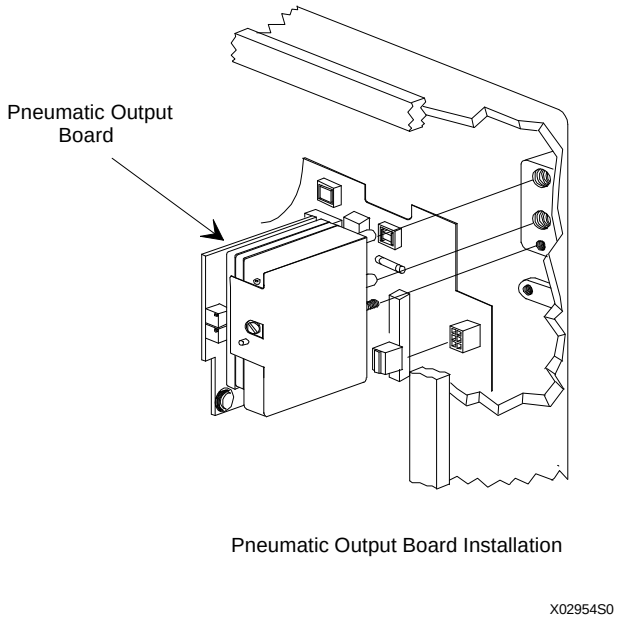


FIGURE 6-7 Pneumatic Output Board

REMOVAL:

1. Remove power from the FIELDPAC.
2. Connect a wrist strap to the ground screw on the right side of the FIELDPAC enclosure.
3. Open the display/keyboard cover assembly by unscrewing the four 10-32 x 5/8” captive screws and swinging it open on its left hinges.
4. Remove the pneumatic output board by unscrewing the single captive screw, and unplug the board from its mating connector on the MPU controller board.

INSTALLATION:

1. Ensure power is OFF at the FIELDPAC and wrist strap is connected to the ground screw on right side of FIELDPAC enclosure.
2. Remove the new pneumatic output board from its static shielding bag.

3. Line up the connector pins of the pneumatic output board with the mating connector on the MPU controller board and push the pneumatic output board against the MPU controller board until the connector is properly engaged.

4. Tighten the single captive screw to secure the board to the enclosure.

6.5.7 Direct Pressure Sensor Input

To replace or install the direct pressure sensor input, refer to Figure 6-8 and use the following procedure.

REMOVAL:

1. Remove power from the FIELDPAC.

2. Ground the wrist strap.

3. If removing a Model 340D sensor, remove two screws securing the mounting bracket from the sensor.

4. Open the upper door assembly by unscrewing the four captive screws and swinging it open on its left hinges.

5. Unplug the sensor connector from the MPU controller board.

6. Remove the retaining screw.

7. Remove the 1/4 plug/set screw using an allen wrench.

8. Remove the sensor by carefully pulling it out of the enclosure.

INSTALLATION:

1. Ensure power is OFF at the FIELDPAC and the wrist strap is grounded.

2. Remove the sensor from its packaging.

3. Insert the sensor into the rear of the enclosure. Notice the orientation shown in the Figure.

4. When using a Model 340 A/G Sensor, install the retaining screw inside the enclosure.

5. Connect the cable to the MPU controller board. Notice that the connector is keyed.

6. Install the ¼ plug/setscrew, using an allen wrench, to secure the sensor.

7. If installing a Model 340D Sensor, install the mounting bracket.

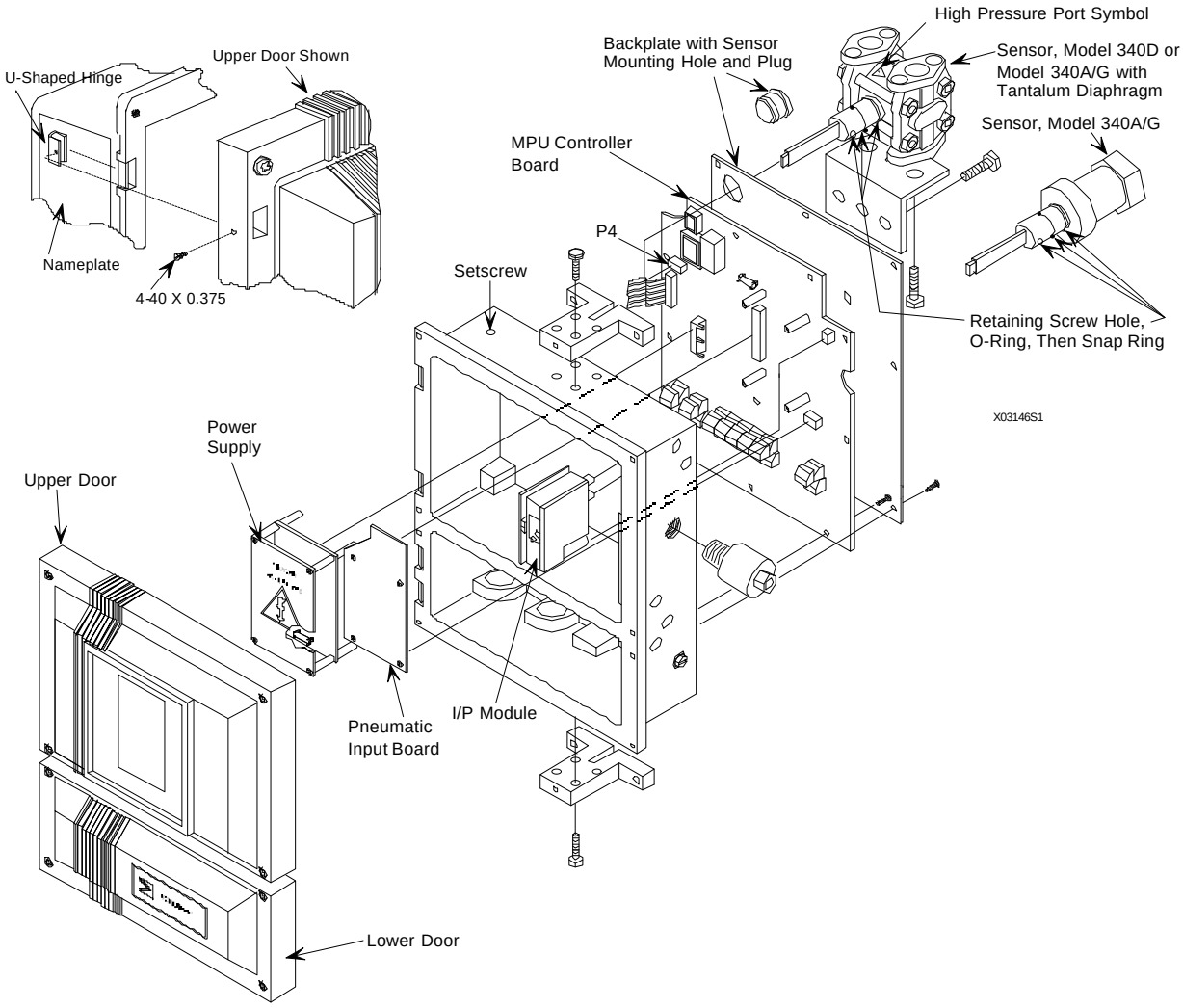


FIGURE 6-8 Direct Pressure Sensor Input

6.5.8 MPU Controller Board

To replace or install the MPU controller board, refer to Figure 6-9 and use the following procedure:

REMOVAL:

1. Remove power from the FIELDPAC.

2. Ground the wrist strap.

3. Open the upper door assembly by unscrewing the four captive screws and swing it open on its left hinges. Disconnect the MPU controller board ribbon cable from the display board.

4. Remove and label all wiring connections. If a direct pressure sensor Input is installed, refer to "Direct Pressure Sensor Input" section and remove the direct pressure sensor Input. If a pneumatic input board is installed, disconnect the pneumatic tubing from the pneumatic connections at the enclosure manifold.

5. Remove the eight screws which attach the rear plate to the enclosure.

6. Remove the nine screws which attach the board to the case.

7. Lift the board from the case.

INSTALLATION:

1. Ground the wrist strap.

2. Remove the circuit board from the static shielding bag.

3. Lower the board onto the case and connect it by installing the nine screws.

4. Connect the rear plate to the enclosure by installing the eight screws.

5. Install the direct pressure sensor Input and the pneumatic tubing connections, if necessary.

6. Reconnect all wiring connections to the terminal blocks.

7. Connect the MPU controller board ribbon cable to the Display board.

8. Close the upper door assembly and secure it using the four captive screws.

9. Reconfigure and calibrate the MPU controller board.

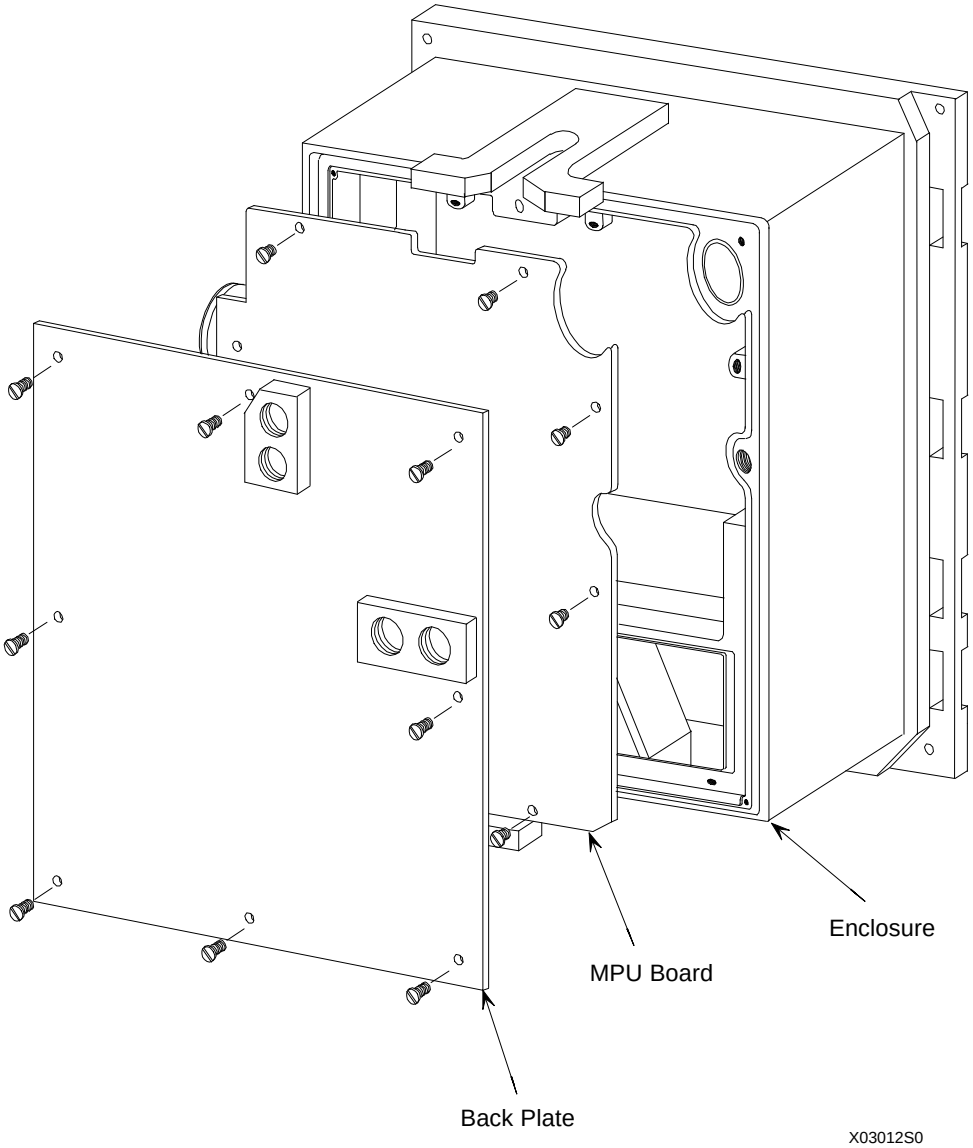


FIGURE 6-9 MPU Controller Board

6.6 RECOMMENDED SPARE AND REPLACEMENT PARTS

It is recommended that one spare of each of the following items be stocked for every 1 to 25 units in service:

- Fuses
- Display/Keyboard Cover Assembly
- AC Power Supply
- Temperature Sensor Board (if used)
- Pneumatic Input Board (if used)
- Pressure Sensor (if used)
- I/P Module (if used)
- MPU Controller Board

The Parts Lists in the back of this manual lists the Model 348 Field Mounted Controller module assemblies and parts that are available from the factory.

IMPORTANT

When ordering a replacement or spare assembly, provide the following data from the assembly to be replaced or spared: part number, software version, and serial number.

An item being returned to the factory should be packaged in its original shipping container. Otherwise, package for safe shipment or contact the factory for shipping recommendation. Send package to one of the addresses given in the Warranty Statement.

IMPORTANT

A circuit board must be placed in a static shielding bag before it is packaged for shipment.

6.7 MAINTENANCE RECORDS

An accurate record keeping system for maintenance operations should be established and kept up to date. Data extracted from the record can serve as a basis for ordering supplies such as spare parts. In addition, it is useful as a troubleshooting tool by providing historical maintenance data. Scheduled and unscheduled maintenance should be recorded.

6.8 TO RETURN EQUIPMENT

- Call the Service Department at +1 215 646 7400, ext. 4RMA (4762) weekdays between 8:00 a.m. and 4:45 p.m. Eastern Time to obtain an RMA number. Mark the RMA number prominently on the outside of the shipment.

- When calling for an RMA number, provide the reason for the return. If returning equipment for repair, failure information (e.g., error code, failure symptom, installation environment) will be requested. A purchase order number will also be needed.

MATERIAL SAFETY DATA SHEET

- A Material Safety Data Sheet (MSDS) must be included with each item being returned that was stored or used anywhere hazardous materials were present.

PACKAGING

- Package assembly in original shipping materials. Otherwise, package it for safe shipment or contact the factory for shipping recommendations.

- A module must be placed in a static shielding bag to protect it from electrostatic discharge.

■

7.0 CONFIGURATION

Configuration is accomplished by designing and then entering a controller strategy into the FIELDPAC to meet an individual process requirement. This is done by selecting function blocks from an available library, deciding how to interconnect them, and entering this configuration into the FIELDPAC.

The simplest way is to select a Factory Configured Option (FCO) and make minor changes, as necessary, to meet individual requirements. This approach will satisfy a large percentage of process control designs. The FCO's are documented in section 9 of this manual.

In cases where a 'Design From Scratch' approach is used, the following guidelines will be useful in completing a configuration:

Draw a diagram of the blocks and the interconnections. Include the identifying numbers and letters of all block inputs and outputs that are used. The diagrams of the FCO's in "FCO" section are examples of these diagrams. The main purpose of the diagram is to illustrate the operation of the controller design and assist in filling out the Configuration Documentation in Appendix B.

Complete the configuration booklet, filling in the parameters for all the function blocks being used. Some parameters, particularly the Soft (S), may not be know initially and can be filled-in at a later time.

7.1 CONFIGURATION MODES

T - Execution Sequence Numbers (ESN) should be assigned to each function block being used. The ESN is usually not critical, but inputs to a block should normally be executed before the block executes. It is also recommended to skip numbers to allow for future additions. Numbers 00 to 99 can be used, with 00 indicating that the block is not being used. Only those blocks with non zero execution numbers are active in the other configuration modes, thus limiting entry of configuration parameters to blocks of your choosing.

H - Hard Configuration, generally assigns specific block functions and interconnections (function blocks are 'wired' together). Block inputs can be assigned numbers from 00 to 99 representing outputs from other blocks.

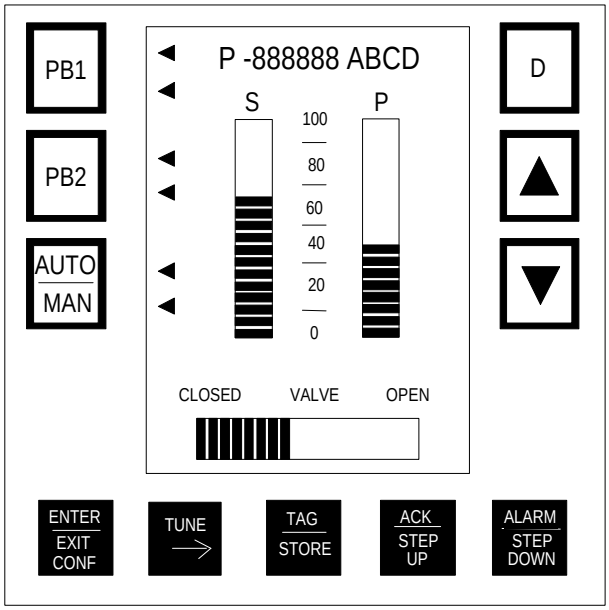
S - Soft Configuration, generally covers variable parameters such as tuning constants, gains, etc. that may change periodically depending on the application.

C - Calibration is provided to standard requirements when shipped from the factory and should not be required unless changes are necessary. Complete information regarding calibration can be found section 4.

V - View allows each block output to be viewed as a 0-100% value. This mode is useful in the troubleshooting of configuration designs.

F - Factory Configured Options are available to simplify the entry of many standard configuration requirements. These designs can also be used as guides for individual designs.

Enter the information from the configuration booklet into the FIELDPAC using the pushbuttons on the faceplate. Detailed information on the use of the pushbuttons can be found under “Operator's Display” section.

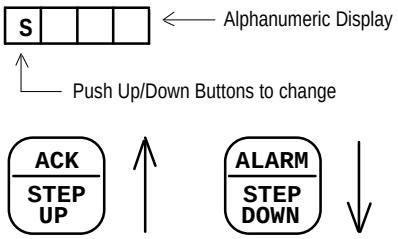


Check the configuration by simulating inputs and monitoring the outputs. Individual block outputs can be viewed using the View Mode (V).

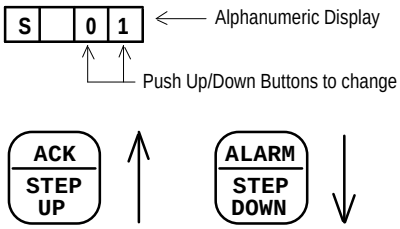
A Configuration Software Package is also available that simplifies the configuration process. This software will enable the uploading of existing configurations, resident in the Field Mounted Controller, and provide the capability of editing the configuration and saving it to disk. Configurations can also be printed in a form very similar to the Configuration Booklet. The software also provides for the downloading of a configuration to a Field Mounted Controller.
The configuration controls on the faceplate of the Model 348 are used to select a specific parameter and then enter a value for that parameter. This page provides an overview of that procedure. For those familiar with the Model 352, the functions are very similar but there are some differences. Read this page carefully (e.g. the ----> button changes the digit that will be changed by the UP/DOWN arrow buttons).

Push to enter the Configuration Mode. Enters at the menu level. The Step Down button will move you to a new configuration level.

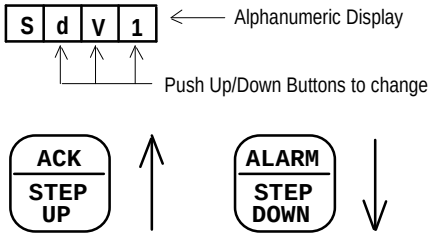
MENU LEVEL



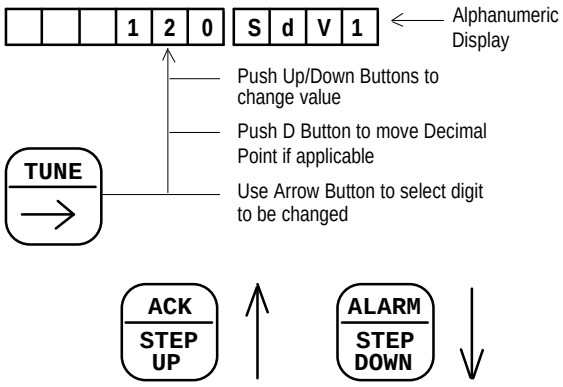
FUNCTION BLOCK LEVEL



PARAMETER LEVEL



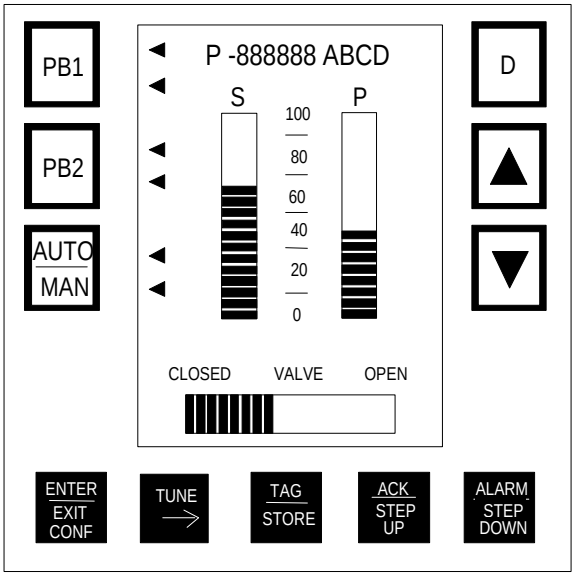
VALUE LEVEL



Push to store value in the display
(only active at the Value Level)

Push to Exit Configuration
(Active at any level)

The operators display can be configured to meet individual requirements using the parameters available in FB15. This page provides an overview of this display from an operator's perspective.



Digital Display
Displays operator and configuration information. Located at the top of the faceplate, it includes: one alphanumeric character to indicate the variable being displayed; a minus sign; six characters to indicate the numeric value of the variable (also used in configuration for parameter selections); four alphanumeric characters to indicate engineering units, status mnemonic, or configuration mnemonics.

D Pushbutton
Used to step the digital display through a sequence of the following variables which may be active depending on the individual configuration.

P - Process. The digital value of the variable displayed in the vertical bargraph P. The 4-character alphanumeric, displays the configured engineering units. In cases where 2 loops have been configured (e.g. Cascade) two process variables are available and the configuration should provide a means (e.g. PB1, PB2, ...) to select the proper process variable for display.

S - Setpoint. The digital value of the variable displayed in the vertical bargraph S. The 4-character alphanumeric will display the configured engineering units, the same as the Process in a Loop configuration. When the setpoint is displayed, the value can be changed, provided the setpoint is active and not in a tracking mode. In cases where 2 loops have been configured (e.g. Cascade) two setpoints may be available and the configuration should provide a means (e.g. PB1, PB2, ...) to select the proper setpoint variable for display and change.

V/O - Valve/Output. The digital value of the variable displayed in the horizontal bargraph. The 4-character alphanumeric will display PRCT for this variable. In cases where 2 loops have been configured two valve/output signals may be available (e.g. Cascade, generally will only have one valve) and the configuration should provide the means (e.g. PB1, PB2, ...) to select the proper valve variable for display and change. This variable is configurable for display as **V**ALVE or **O**UT. The figure shows the faceplate with **V**ALVE configured. When **O**UT is configured, the words over the bargraph will be blanked out and **'0 OUT 100'** will appear under the bargraph. The horizontal bargraph action can also be configured as DIRECT or REVERSE. This is useful when the bargraph is indicating the valve position and a full bargraph always indicates an OPEN valve. The digital display, in either case, will display the value in percent.

X - The digital value of the variable X. The 4-character alphanumeric will display the configured engineering units for this variable. This is active, only when INX is configured for FB15.

Y - The digital value of the variable Y. The 4-character alphanumeric will display the configured engineering units for this variable. This is active, only when INY is configured for FB15.

R - The value of the RATIO. This will only be displayed when FB07 is active.

B - The value of the BIAS. This will only be displayed when FB08 is active. BIAS can be configured for display as PRCT or the engineering units of the variables P1 (Process 1), P2 (Process 2), X, or Y.

C - The total counts of the totalizer block FB16. The 4-character alphanumeric will display the count units (e.g. GAL).

M - The Multiplier to be used with the count (e.g. if the display has a value of 120 and M = 1000, the actual count would be 120,000 GAL).

1 - The value of Preset 1 for the totalizer. This will have the same units and multiplier as COUNT.

2 - The value of Preset 2 for the totalizer. This will have the same units and multiplier as COUNT.

PB1 Pushbutton
A general purpose pushbutton associated with FB23 that can be configured as momentary or sustained and used in a variety of applications from starting or stopping logic functions to switching between loops. LCD triangle

indicators show the position of the sustained pushbutton action. This particular button is also reserved for selecting Console/Local control, if required.

PB2 Pushbutton
A general purpose pushbutton associated with FB11 that can be configured as momentary or sustained and used in a variety of applications. LCD triangle indicators show the position of the sustained pushbutton action.

AUTO/MAN Pushbutton
This pushbutton is usually associated with A/M Transfer Switch #1 (FB14) and may also be associated with A/M Transfer #2 (FB55) when two loops have been configured. The LCD triangle indicators show the position of the sustained pushbutton action. This function should always be associated, through configuration, with the signal being displayed as the Valve or Output.

UP/DOWN Pushbutton
These pushbuttons change the value of the displayed variable (e.g. when **B** is displayed, the buttons change the BIAS value). The one exception is that the Valve/Output can still be changed while displaying the respective Process variable.

Status Window
The four character display will normally show the engineering units of the displayed variable. When a status condition occurs, such as an alarm, the status will stack up behind the engineering units and can be viewed by pressing the ACK pushbutton. When a status is present, the decimal points in the four character display will blink. This indicates that the window for the statuses, can be opened to view them. While viewing the statuses the blinking will stop. If the ACK button is not pressed for 5 seconds, the window will close, again displaying the engineering units.

The status display will have the following format:

A2*3

The first two characters indicate the status condition (e.g. A2 represents Alarm #2). The asterisk indicates that at least one of the statuses is an active alarm and the number indicates the total number of statuses that can be displayed. The complete list of status mnemonics is in table 1 of the FB15 description.

Bargraph Flashers
Any of the status conditions can be configured (parameters HFL1 to HFL5 in FB15) to cause the bargraphs to flash. When a status condition occurs that has been configured, the bargraphs will flash on & off and the status window will open automatically showing the status mnemonic that caused the flashing to occur. When the flashing has been acknowledged and there are no more flashing statuses, the status window will return to normal operation, and display any engineering units.

TUNE Pushbutton
Pressing the TUNE button will first cause 'LOOP 1 TUNE' to appear in the 4-character display if FB13 has been configured. When 'LOOP _ TUNE' has been selected, repeated pressing of the STEP DOWN button will step through the tuning parameters for that loop controller. STEP UP will reverse the sequence.

TAG Pushbutton
Pressing the TAG button will cause the loop tag\s (as configured in FB15) to scroll through the 4-character display. The time required to scroll the tag is also configurable in FB15.

ALARM Pushbutton
Pressing the ALARM button will first cause 'LOOP 1 ALM' to appear in the 4-character display if FB12 has been configured. Pressing the ---> button will cause 'LOOP 2 ALM' to appear if FB73 has been configured. Repeated pressing of the STEP DOWN button will step through the tuning parameters for that loop alarm. STEP UP will reverse the sequence.

ACK Pushbutton
The ACK button can be used to open the 4-character window to display and step through any active statuses (e.g. Alarms). It is also used to acknowledge flashing bargraphs and the associated status.

■

8.0 FUNCTION BLOCK DESCRIPTIONS

This section provides a detailed description and specifications for each function block type. It also provides function block connection details and listings of all configuration parameters.

TABLE 8-1 Function Block by Type

FUNCTION BLOCK TYPE	FUNCTION BLOCK NAME	FUNCTION BLOCK NUMBER	PAGE NUMBER
8.1 Analog Input	Analog Input #1, #2, #3	1, 2, 25	8-4
8.2 Analog Output	Analog Output #1, #2	3, 29	8-5
8.3 Digital Input	Digital Input #1, #2	6, 30	8-6
8.4 Digital Output			
8.4.1	Digital Output #1, #2	4, 5	8-7
8.4.2	Isolated-Digital Output #1, #2	32, 33	8-8
8.4.3	Pulse Integrator	28	8-9
8.5 Pressure Sensor Input	Pressure Sensor Input	81	8-10
8.6 Temperature Sensor	Temperature Sensor	82	8-11
8.7 Pneumatic Input	Pneumatic Input #1, #2, #3	85, 86, 87	8-12
8.8 Controller			
8.8.1	PID Controller #1, #2	13, 45	8-13
8.8.2	PD Controller #1, #2	13, 45	8-15
8.8.3	ID Controller #1, #2	13, 45	8-17
8.8.4	PIDA Controller #1, #2	13, 45	8-19
8.9 Transfer			
8.9.1	A/M Transfer #1, #2	14, 55	8-21
8.9.2	PB Transfer #1, #2	23, 11	8-23
8.9.3	General Purpose Transfer	49	8-24
8.9.4	Triple Transfer Switch	71	8-25
8.10 Track & Hold			
8.10.1	Setpoint Track & Hold #1, #2	17, 46	8-26
8.10.2	General Purpose Track & Hold	18	8-27
8.10.3	General Purpose Hold	19	8-28
8.11 Signal Selector	Override Selector	10	8-29
8.12 Logic			
8.12.1	Logic #1 - #9	20, 21, 48, 50, 61, 62, 88, 89,	8-30
8.12.2	Delay Timer	90	8-31
8.12.3	One Shot Timer	65	8-32
8.12.4	Repeat Cycle Timer	67	8-33
		47	

(continued on next page)

TABLE 8-1 Function Block by Type (Continued)

8.13 Ratio & Bias			
8.13.1	Ratio	7	8-34
8.13.2	Bias	8	8-35
8.14 Hi/Lo Limit	Hi/Lo Setpoint Limit #1, #2	9, 51	8-36
8.15 Alarms			
8.15.1	Alarm #1, #2	12, 73	8-37
8.15.2	Quad Comparator	64	8-39
8.16 Operator's Display	Operators Display	15	8-40
8.17 Dynamic			
Compensation	Lag	40	8-43
8.17.1	Lead	41	8-44
8.17.2	Rate Limiter	42	8-45
8.17.3	Dead Time Table	43	8-46
8.17.4			
8.18 Math			
8.18.1	Math #1, #2, #3	34, 35, 36	8-47
8.18.2	Gain & Bias #1, #2	38, 39	8-48
8.18.3	Deviation Amplifier	22	8-49
8.18.4	Square Root Extractor	24	8-50
8.18.5	Integrator/Totalizer	16	8-51
8.18.6	10 Segment Characterizer #1, #2	44, 72	8-53
8.19 Miscellaneous			
8.19.1	Batch Switch	53	8-54
8.19.2	Password Security	75	8-55
8.19.3	Hart Interface	98	8-56

Function Blocks (Numerical Order)

FB01 ..... Analog Input #1
FB02 ..... Analog Input #2
FB03 ..... Analog Output #1
FB04 ..... Digital Output #1
FB05 ..... Digital Output #2
FB06 ..... Digital Input #1
FB07 ..... Ratio
FB08 ..... Bias
FB09 ..... Hi/Lo Setpoint Limit #1
FB10 ..... Override Selector
FB11 ..... PB Transfer #2
FB12 ..... Alarm Block#1
FB13 ..... PID Controller #1
FB14 ..... A/M Transfer #1
FB15 ..... Operator Display
FB16 ..... Integrator/Totalizer
FB17 ..... Setpoint Track & Hold #1
FB18 ..... General Purpose Track & Hold
FB19 ..... General Purpose Hold
FB20 ..... Logic Block #1
FB21 ..... Logic Block #2
FB22 ..... Deviation Amplifier
FB23 ..... PB Transfer #1
FB24 ..... Square Root Extractor
FB25 ..... Analog Input #3
FB28 ..... Pulse Integrator
FB29 ..... Analog Output #2
FB30 ..... Digital Input #2
FB32 ..... Isolated Digital Output #1
FB33 ..... Isolated Digital Output #2
FB34 ..... Math Block #1
FB35 ..... Math Block #2
FB36 ..... Math Block #3
FB38 ..... Gain & Bias #1

FB39 ..... Gain & Bias #2
FB40 ..... Lag
FB41 ..... Lead
FB42 ..... Rate Limiter
FB43 ..... Dead Time Table
FB44 ..... 10-Segment Characterizer #1
FB45 ..... PID Controller #2
FB46 ..... Setpoint Track & Hold #2
FB47 ..... Repeat Cycle Timer
FB48 ..... Logic Block #3
FB49 ..... General Purpose Transfer
FB50 ..... Logic Block #4
FB51 ..... Hi/Lo Setpoint Limit #2
FB53 ..... Batch Switch
FB55 ..... A/M Transfer #2
FB61 ..... Logic Block #5
FB62 . ..... Logic Block #6
FB64 ..... Quad Comparator
FB65 ..... Delay Timer
FB67 ..... One Shot Timer
FB71 ..... Triple Transfer Switch
FB72 ..... 10-Segment Characterizer #2
FB73 ..... Alarm Block #2
FB75 ..... Password Security
FB81 ..... Pressure Sensor
FB82 ..... Temperature Sensor
FB85 ..... Pneumatic input #1
FB86 ..... . Pneumatic input #2
FB87 ..... Pneumatic input #3
FB88 ..... Logic Block #7
FB89 ..... Logic Block #8
FB90 ..... Logic Block #9
FB98 ..... Hart Interface

8.1 ANALOG INPUT #1/#2/#3 FB01/FB02/FB25

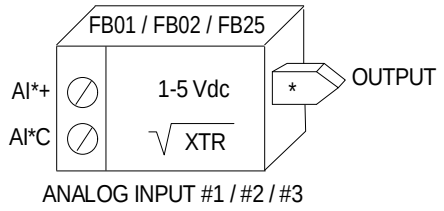
These function blocks convert an analog voltage with a range defined during calibration into a 0-100% block output signal for interconnection to other function blocks.

Also included is a digital filter, to dampen process noise and a square root extractor to linearize a flow signal from a DP transmitter. When the square root extractor is enabled, the function block output is low limited to 0%. See Function Block 24 for more details on the square root extractor function. Calibration details can be found in section 4, of this manual.

A verify mode is available in calibration to view the input as a 0-100% block output signal over the full calibrated range.

FB01 is not available when FB85, FB86, or FB87 is configured.
FB25 is not available when FB87 is configured.

ANALOG INPUT #1 / #2 / #3
FB01 / FB02 / FB25



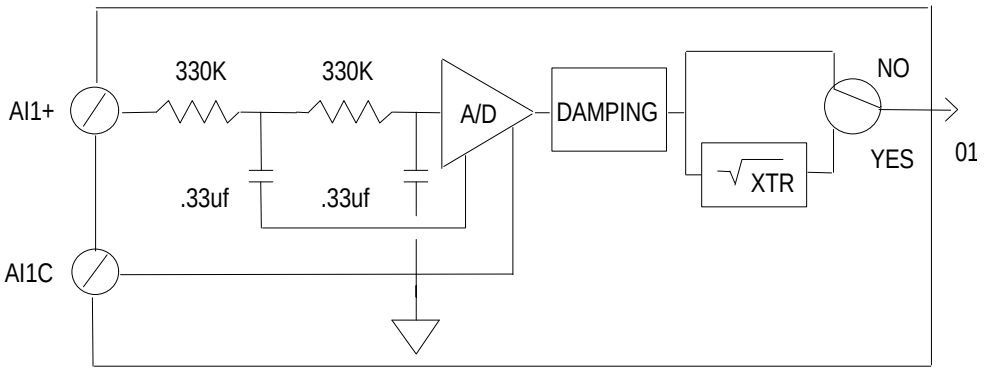
ANALOG INPUT #1 / #2 / #3

S	D	V	**	DAMPING VALUE ..... 0 to 180 SEC
C	Z	I	**	ZERO INPUT ..... 0.0 to 1.0 Vdc
C	F	I	**	FULL SCALE INPUT ..... 4.0 to 5.0 Vdc
C	V	I	**	VERIFY INPUT ..... -10.00 to 110.00%
H	S	R	E	SQUARE ROOT EXTRACTOR ..... NO/YES

* See Output Identifications and Terminal Designations
** FB01: 1, FB02: 2, FB25: 3

FB Number	Output Identification	Terminal Designations
01	01	AI1+: F7 AI1C: F8
02	02	AI2+: F10 AI2C: F11
25	30	AI3+: F13 AI3C: F14

Specifications
Calibration: Zero: 0 to 1 Vdc
Span: 4 to 5 Vdc
Standard Calibration: 1 to 5 Vdc
Hardware Filter: 2 Hz (2-pole)
Damping Filter: 0 to 180 sec.
Accuracy: +/- 0.05% of span
A/D Resolution: 12 bit
A/D Linearity: LSB
Ambient Temp. Effect: +/-0.50% D50 deg. C
Max. Continuous Input: +/- 30 Vdc
Input Impedance: > 1 megohm



BLOCK DIAGRAM

8.2 ANALOG OUTPUT #1/#2 FB03/FB29

This function block converts a 0-100% block interconnection signal into a 4-20 mAdc analog output. Also included is a switch that will disconnect the output from the load. This feature is useful when two or more outputs are connected to the same load. Calibration details can be found in section 4 of this manual.

Pneumatic Output Option (Analog Output #1 only)

A pneumatic output option is available that uses Analog Output #1 to convert the block 0-100% interconnection input signal into a pneumatic output (3-15 PSIG or 3-27 PSIG). The current output terminals should not be used when this option is installed.

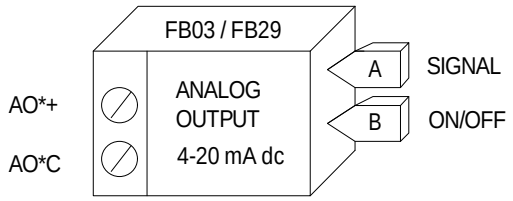
Specifications

Calibration: Zero: 4.0 mAdc +/- trim
Span: 16.0 mAdc +/- trim
Standard Calibration: 4-20 mAdc
Output Load: 0-800 ohm @ 24Vdc
Max. Output Current:
0 to Lm Ohms
DC Powered: Lm=[Vsupply-6.83v]/ 21.6 mA
AC Powered: Lm=800 Ohms
Min. Output Current: 3.5 mA
Accuracy: +/- 0.1% of span
Ambient Temp. Effect: <0.5% 50 deg. C
Output Switch: Closed B>= 80%
Open B< 75%

Pneumatic Specifications

Accuracy: +/- 0.25% of span
Amb. Temp. Effect: +/- 1.0% 50 deg. C

ANALOG OUTPUT #1 / #2
FB03 / FB29

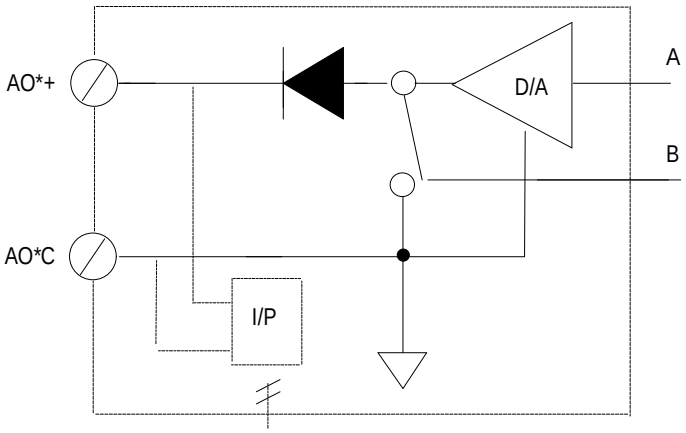


ANALOG OUTPUT #1/ #2

C	Z	O	**	ZERO OUTPUT ..... 4.0 mAdc
C	F	O	**	FULL SCALE OUTPUT ..... 20.0 mAdc
C	V	O	**	VERIFY OUTPUT ..... -10.0 to 110.0%
H	I	N	A	INPUT A (SIGNAL) ..... 00 to 99
H	I	N	B	INPUT B (ON/OFF) ..... 00 to 99

* See Terminal Designations
** FB03: 1, FB29: 2

FB Number	Terminal Designations
03	AO1+: E11 AO1C: E12
29	AO2+: E13 AO2C: E14



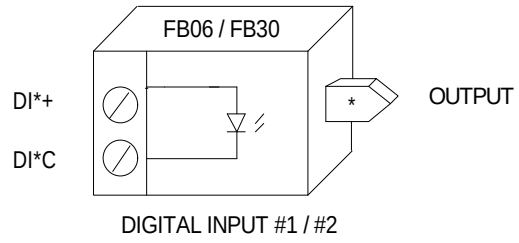
PNEUMATIC OUTPUT OPTION
(used with Analog Output #1 only)
BLOCK DIAGRAM

8.3 DIGITAL INPUT #1/ #2 FB06/FB30

This function block converts an ON/OFF input signal into a block interconnection signal that is 0% when the input is OFF and 100% when the input is ON. The normal ON input voltage is 24Vdc.

This block is often used for connecting on/off external signals to internal logic inputs such as Acknowledge (FB15), Emergency Manual (FB14), Standby Sync (FB14), ...

DIGITAL INPUT #1 / #2
FB06 /FB30

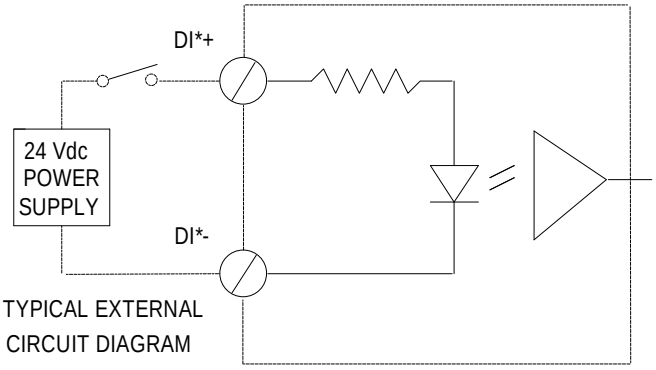


DIGITAL INPUT #1 / #2

* See Output Identifications and Terminal Designations

Specifications
ON Voltage: 12-30 Vdc
OFF Voltage: 0-5 Vdc
Input Current @ 24Vdc: 10 mAdc
Overvoltage Protection: 30 Vdc
Isolation: 100 Vdc
Action: Input > 12 Vdc O=100%
Input < 5 Vdc O=0%

FB Number	Output Identifications	Terminal Designations
06	Digital Input Signal: 16	DI1+: E7 DI1-: E8
30	Digital Input Signal: 58	DI2+: E9 DI2-: E10



TYPICAL EXTERNAL
CIRCUIT DIAGRAM

BLOCK DIAGRAM

8.4 DIGITAL OUTPUT

8.4.1 DIGITAL OUTPUT #1/#2 FB04/FB05

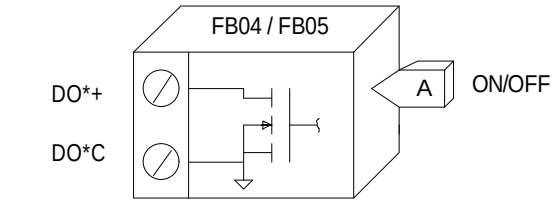
These function blocks provide a solid state output switch that turns on when input A goes high (>=80%) and will turn off when input A goes low (<75%) or is not configured.

The digital output can be powered from the same 24Vdc supply powering the Model 348 noting that the negative side of the power supply is tied to the Model 348 COMMON. On AC powered units the 80mA transmitter supply can be used for small loads or an external dc supply for larger loads.

Additional details for connecting solid state outputs to various loads such as relays and solid state annunciators can be found in section 2 of this manual.

Specifications
Output Type: MOSFET Transistor
Min. Load Voltage: 0 Vdc
Max. Load Voltage: 30 Vdc
Max. Load Current: 150 mAdc
Switch Action: Closed INA >= 80%
Open INA < 75%
Transistor ON Voltage: 0.6 Vdv @ 100 mA
Transistor OFF Leakage: 0.5 uA @ 30 Vdc

DIGITAL OUTPUT #1 / #2
FB04 / FB05

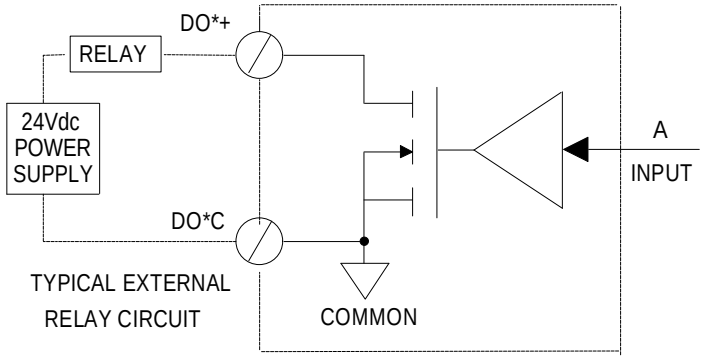


DIGITAL OUTPUT #1 / #2

H	I	N	A	INPUT A (ON/OFF) .....00 to 99

* See Terminal Designations

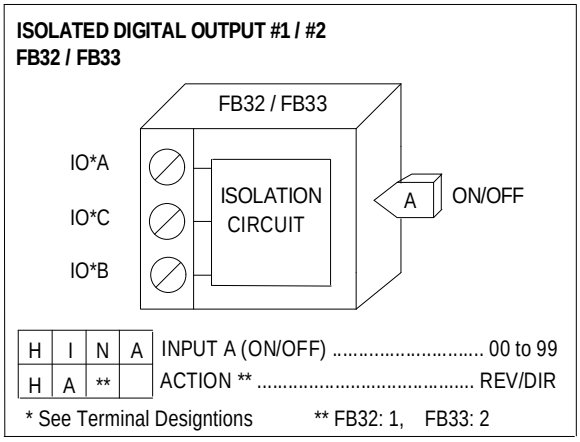
FB Number	Terminal Designations
04	DO1+: E1 DO1C: E2
05	DO2+: E3 DO2C: E4



BLOCK DIAGRAM

8.4.2 ISOLATED DIGITAL OUTPUT #1/#2 FB32/FB33

This function block provides an isolated digital output. The Model 348S has opto transistor outputs and the Model 348E, relay outputs with SPDT contacts. The action of this function block can be configured as direct acting so that the output energizes when Input A goes high (>=80%) or reverse acting so that the output de-energizes when Input A goes high. The output will return to its normal condition when Input A goes low (<75%).



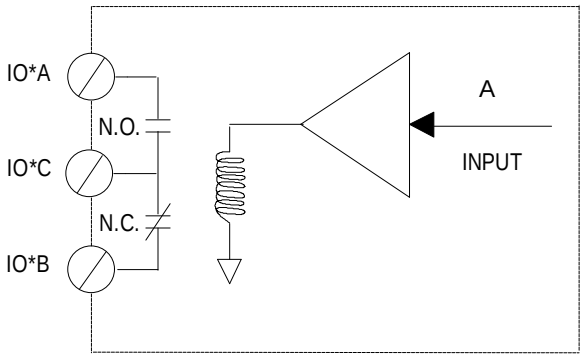
Specifications

Opto Transistor
Max. Load Voltage: 30 Vdc
Max. Load Current: 50 mAdc
ON Voltage: 10 V maximum @ 2 mA load
OFF Leakage: 50 nA maximum @ 30 Vdc

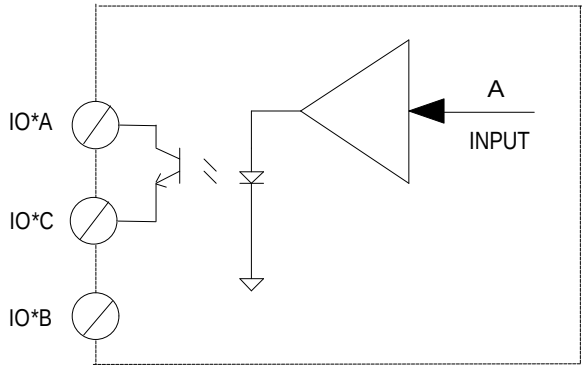
Relay
Type: Epoxy Sealed
Contact Configuration: SPDT (Form C)
Contact Rating: 3 amp @ 250 Vac

Action
Direct: Energized .. A>=80%
De-energized A< 75%
Reverse: De-energized A>=80%
Energized .. A< 75%

FB Number	Terminal Designations
32	IO1A: D2 (Relay NO or Opto +) IO1C: D1 (Relay COM or Opto -) IO1B: D3 (Relay NC)
33	IO2A: C2 (Relay NO or Opto +) IO2C: C1 (Relay COM or Opto -) IO2B: C3 (Relay NC)



BLOCK DIAGRAM - RELAY OUTPUT



BLOCK DIAGRAM -OPTO TRANSISTOR OUTPUT

8.4.3 PULSE INTEGRATOR FB28

This function block integrates input signal A and provides a pulse output for driving an external counter. The Pulse Integrator is configured by setting the Full Scale rate, the Time Base, and the Count Multiplier (similar to FB16). In addition, a pulse width can be selected to meet the many requirements of different counters.

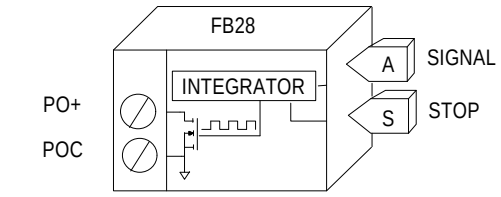
As an example, a 0-100% input represents a flow rate of 0-400 gal/min. Select SFS = 400, STB = MIN, SCM = 1. If the input equals 50% (200 gal/min) for 1 hour the number of pulses sent out in that hour would be 12000.

When the signal is being sent to a high speed electronic counter the Pulse Width can be set at 0.4 msec. In cases where the counter requires a wider pulse width, a pulse width equal to or greater than the counter requirement should be selected. However, it is important that the pulse width has a corresponding pulse rate higher than the output rate required by a full scale input signal. In cases where the Integrator Pulse rate may be momentarily faster than the output rate, pulses will be banked and sent out when possible. The banking register has a capacity of 10 million but in most cases (if the pulse width is selected correctly) will not be needed. In our example, the function block would be required to send out 24000 pulses in an hour when at full scale. This corresponds to 6.7 pulses/sec. In this case, we could set the pulse width at 53 msec since the corresponding maximum pulse rate is 8.7/sec. See Table FB28-1 for the complete listing.

In cases where the signal will be integrated over a long period of time the external counter may overflow. In this case a Count Multiplier greater than 1 can be used. For increased resolution a multiplier less than 1 is used.

Input S (STOP) will stop integration of the input signal when it goes high (>=80%). If the STOP

PULSE INTEGRATOR
FB28



S	F	S		FULL SCALE VALUE ..... .000000 to 999999
S	T	B		TIME BASE ..... SEC/MIN/HR/DAY/WK
S	C	M		COUNT MULTIPLIER ..... .000001 to 999999
S	Z	D		ZERO DROP OUT ..... 0.0 to 30.0%
S	P	W		PULSE WIDTH .. 0.4/0.8/1.6/3.2/13/26/53/106
H	I	N	A	INPUT A (SIGNAL) ..... 00 to 99
H	I	N	S	INPUT S (STOP) ..... 00 to 99

Input is asserted any banked pulses will be sent out, but new ones will not be added.

Specifications
Output Type: MOSFET Transistor
Max. Load Voltage: 30 Vdc
Max. Load Current: 150 mAdc
Transistor ON Voltage: 0.6 Vdv @ 100 mA
Transistor OFF Leakage: 0.5 uA @ 30 Vdc

TABLE FB28-1 Pulse Width and Maximum Rate

Pulse Width	Max. Rate
0.4 msec	1120/sec
0.8 msec	520/sec
1.6 msec	240/sec
3.2 msec	80/sec
13 msec	25/sec
26 msec	14/sec
53 msec	8.7/sec
106 msec	4.5/sec

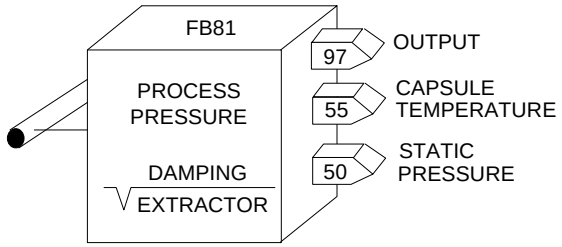
8.5 PRESSURE SENSOR INPUT FB81

This function block is active when a Process Pressure Input option has been installed and FB81 has an active execution sequence number. The block provides parameters for selecting the range of the 0-100% block output signal, a damping time constant, and the option of linear or square root characterization. The square root option is only available on P sensor types.

The range and span limits are determined by the particular sensor being used. See Table FB81-1 for the various ranges associated with the Process Pressure models.

FB Number	Output Identification
81	97
	50*
	55*

PRESSURE SENSOR FB81



PRESSURE SENSOR

SDVP	DAMPING VALUE ..... 0-180 sec
SMVU	MEAS. VARIABLE UNITS ..... Table FB81-2
SMVL	MV RANGE LOW ..... -999999 to 999999
SMVH	MV RANGE HIGH ..... -999999 to 999999
CMP	MOUNTING POSITION ..... Section 4.6
CVIP	VERIFY INPUT ..... -10.00 to 110.00%
HSRE	SQUARE ROOT EXTRACTOR ..... NO/YES

TABLE FB81-1 Process Ranges

340AD	10-450"H_20(abs)
340AF	350"H_20-450PSIA
340DB	0.75-15"H_20
340DD	10-450"H_20
340DF	350"H_20-150PSIG
340GD	10-450"H_20
340GF	350"H_20-450PSIG
340GG	300-5500PSIG
Static Pressure	0-1200PSI
Capsule Temperature	-40 to +125° C

TABLE FB81-2 MV Units

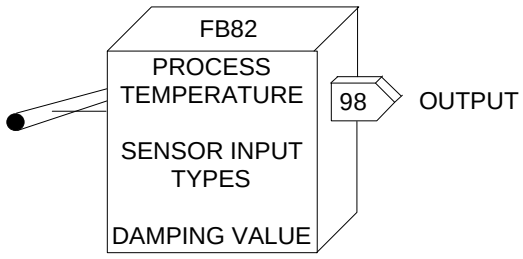
1-InH_20	8-mbar
2-InHG	9-SqCm
3-FtH_20	10-kg/SqCm
4-mmH_20	11-PA
5-mmHg	12-kPA
6-psi	13-torr
7-bar	14-ATM

8.6 TEMPERATURE SENSOR FB82

This function block is active when Analog Input Option 'T' has been installed and FB82 has an active execution sequence number. The block provides parameters for selecting the input type, the range of the 0-100% block output signal, and a damping time constant.

The range and span limits are determined by the particular sensor (see Table FB82-1) being used. See Table FB82-2 for the various ranges associated with sensor types.

TEMPERATURE SENSOR FB82



TEMPERATURE SENSOR

S	D	V	P	DAMPING VALUE.....0-180 sec
S	M	V	U	MEAS. VARIABLE UNITS....Table FB82-2
S	M	V	L	MV RANGE LOW.....-999999 to 999999
S	M	V	H	MV RANGE HIGH.....-999999 to 999999
C	W	M	Z	WIDE MILLIVOLT ZERO.....-18 mv
C	W	M	F	WIDE MILLIVOLT FS.....103 mv
C	N	M	Z	NARROW MILLIVOLT ZERO.....-11 mv
C	N	M	F	NARROW MILLIVOLT FS.....26 mv
C	W	O	Z	WIDE OHM ZERO.....0 ohm
C	W	O	F	WIDE OHM FS.....1875 ohm
C	N	O	Z	NARROW OHM ZERO.....0 ohm
C	N	O	F	NARROW OHM FS.....470 ohm
C	V	I	P	VERIFY INPUT.....-10.00 to 110.00%
H	I	T		INPUT SENSOR TYPE.....Table FB82-1
H	B	O	D	BURNOUT DIRECTION.....UP/DOWN

Specifications

TABLE FB82-1 Input Types

0	Narrow Millivolt
1	Thermocouple Type 'R'
2	Thermocouple Type 'S'
3	Thermocouple Type 'T'
4	Thermocouple Type 'B'
5	Wide Millivolt
6	Thermocouple Type 'J'
7	Thermocouple Type 'K'
8	Thermocouple Type 'E'
9	Thermocouple Type 'N'
10	Narrow Ohm
11	RTD DIN 100
12	RTD US 100
13	Wide Ohm
14	RTD DIN 200
15	RTD DIN 500
16	RTD US 200
17	RTD US 500

TABLE FB82-2 Range Units

32	Degrees Celsius
33	Degrees Fahrenheit
34	Degrees Rankine
35	Degrees Kelvin
36	Millivolts
37	Ohms

FB Number	Output Identification
82	98

8.7 PNEUMATIC INPUT #1/#2/#3 FB85/FB86/FB87

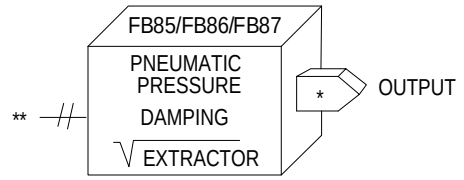
This function block converts a pneumatic (3-15 PSIG or 3-27 PSIG) input signal into a 0-100% block output signal for interconnection to other function blocks. The output can also be calibrated for equivalent metric values (e.g. 20-100 kPa, ...). FB85 will be available when the 1 or 3-input pneumatic option board is furnished. FB86 & FB87 will be available when the 3-input pneumatic option board is furnished

Also included is a digital filter, to dampen process noise and a square root extractor to linearize a flow signal from a P transmitter. See Function Block 24 for more details on the square root extractor function. Calibration details can be found in section 4 of this manual.

A verify mode is available in calibration to view the input as a 0-100% block output signal over the full calibrated range.

This function block is not available if FB01 is configured.

PNEUMATIC INPUT #1 / #2 / #3
FB85 / FB86 / FB87



PNEUMATIC PRESSURE INPUT

S	D	V	**	DAMPING VALUE ..... 0 to 180 SEC
C	Z	I	**	ZERO INPUT ..... 0 to 4 PSIG
C	F	I	**	FULL SCALE INPUT ..... 12 to 15 PSIG
C	V	I	**	VERIFY INPUT ..... -10.00 to 110.00%
H	S	R	E	SQUARE ROOT EXTRACTOR ..... NO/YES

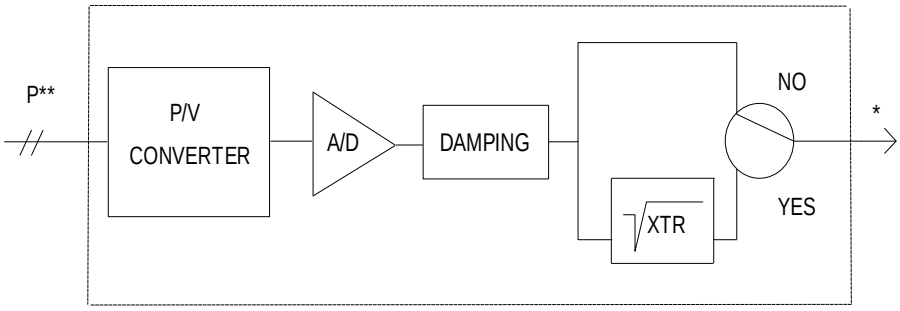
* See Output Identification

** If FB85: 1, FB86: 2, FB87: 3

FB Number	Output Identification
85	Pneumatic Input #1 Signal: 85
86	Pneumatic Input #2 Signal: 86
87	Pneumatic Input #3 Signal: 87

Specifications

Calibration (15 psig sensor):
Zero: 0-4 psig
Full Scale: 12-15 psig
Calibration (30 psig sensor):
Zero: 0-8 psig
Full Scale: 24-30 psig
Accuracy: +/- 0.25% of span
Amb. Temp. Effect: +/- 0.75%
50 deg. C



BLOCK DIAGRAM

8.8 CONTROLLER

8.8.1 PID CONTROLLER #1/#2 FB13/FB45

PID Controller #1 and #2: Controller #1 and #2 function blocks each provide a selection of **PID**, **PD**, **ID**, and **PIDA** (PID with adaptive gain) controller types. This controller is associated with Loop 1 and Loop 2 functions respectively.

The PID controller is a reset type using external feedback to establish integral action. External feedback is necessary to permit interaction with internal function blocks as well as external loop devices (e.g. secondary controller, override controller, shutoff devices, ...), pneumatic or electronic, while eliminating reset windup and valve bumping that can occur with other controller types.

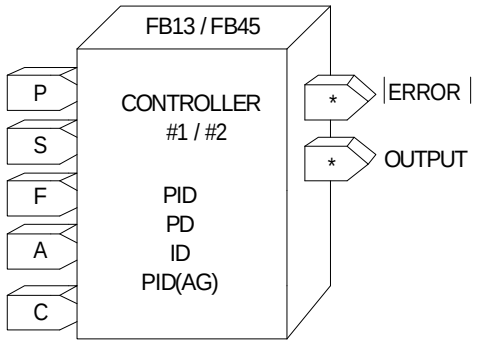
The controller block has an adjustable limit that can be used to set boundries on the controller output signal.

Input C 'Track Command' when high (>=80%) will force the controller output to track Input F 'Feedback'. While in the tracking mode the feedback value will be limited to the values output limit settings, so that the controller output will also not exceed these values. The controller will return to normal when Input C goes low (<75%).

Note: Time-Integral set in minutes/repeat.
Time Derivative set in minutes.

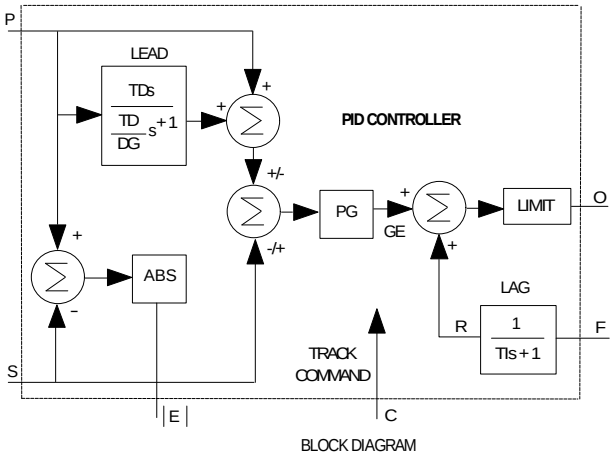
FB Number	Output Identifications
13	Controller Output: 14 |ERROR| Signal: 15
45	Controller Output: 46 |ERROR| Signal: 47

CONTROLLER #1 / #2
FB13 / FB45



S	A	**		ACTION ..... REV/DIR
S	P	G	**	PROPORTIONAL GAIN ..... 0.01 to 100.00
S	T	I	**	TIME - INTEGRAL ..... 0.01 to 1000.00
S	T	D	**	TIME - DERIVATIVE ..... 0.00 to 100.00
S	D	G	**	DERIVATIVE GAIN .....1.00 to 30.00
S	M	R	**	MANUAL RESET ..... 0.0 to 100.0%
S	H	L	**	HIGH OUTPUT LIMIT..... -10.00 to 110.00%
S	L	L	**	LOW OUTPUT LIMIT ..... -10.00 to 110.00%
H	C	**	T	CONTROLLER TYPE ..... PID/PD/ID/PIDA
H	M	R	T	MANUAL RESET TRACKING ..... NO/YES
H	I	N	P	INPUT P (PROCESS) ..... 00 to 99
H	I	N	S	INPUT S (SETPOINT) ..... 00 to 99
H	I	N	F	INPUT F (FEEDBACK) ..... 00 to 99
H	I	N	A	INPUT A (ADAPTIVE GAIN) ..... 00 to 99
H	I	N	C	INPUT C (TRACK COMMAND) ..... 00 to 99

* See Output Identifications
** If Controller #1: 1, If Controller #2: 2



BLOCK DIAGRAM

(continued on next page)

Equations

$$O = GE + R$$

NORMAL (C=0%)

$$R = \frac{F}{TIs + 1}$$

WHEN CONTROLLER OUTPUT IS CONNECTED TO THE FEEDBACK

$$O = +/- PG \left[P \left[1 + \frac{TDs}{(TD/DG)s + 1} \right] - S \right] \left[1 + \frac{1}{TIs} \right]$$

TRACK (C=100%) $R = F - GE \quad \& \quad O = F$

Controller Initialization

Power Up: The controller will initialize with an output of 0% unless FB14 for Loop 1 or FB55 for Loop 2 was configured to power up in Auto and at the last value. In this case the controller will track for two scan cycles to insure that the output will be set equal to the feedback. In most cases the feedback will be the output of FB14 for Loop 1 or FB55 for Loop 2 which under these conditions has held the output value prior to a loss in power.

Switch Transfer: The controller will eliminate any proportional gain action on the first scan cycle after a transfer switch (i.e. FB11, FB23, FB49, FB71) has changed position. This prevents any output bump that could occur due to an abrupt change in the setpoint.

8.8.2 PD CONTROLLER #1/#2 FB13/FB45

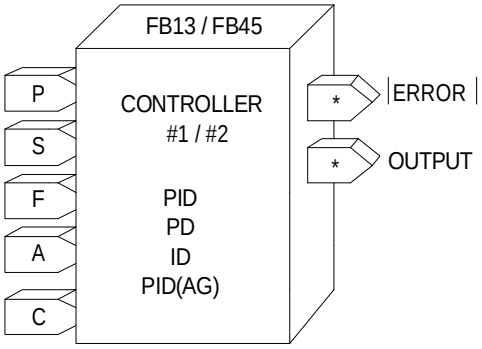
PD Controller #1 and #2: PD Controller #1 and #2 is a proportional only with manual reset, selectable as tracking or non-tracking. This controller is associated with Loop 1 and Loop 2 functions respectively.

Input C 'Tracking Command' when high (>=80%) will force the output to track Input F 'Feedback'. If manual reset tracking is selected **MR** will also track the feedback. While in the tracking mode the feedback value will be limited to the output limit settings, so that the controller output will also not exceed these values. The controller will return to normal when Input C goes low (<75%). In either case the controller always returns to normal action with the output equal to the feedback. The Reset value **R** then returns to the value of **MR** with a time constant established by the **TI** setting. Since the default setting of **TI** is set at 100 min./repeat it should be reduced to a more reasonable time (e.g. .01 min.).

When the Derivative Time **TD** is set to 0.00 the derivative action is eliminated. When set, **TD** is in minutes.

FB Number	Output Identifications
13	Controller Output: 14 |ERROR| Signal: 15
45	Controller Output: 46 |ERROR| Signal: 47

CONTROLLER #1 / #2
FB13 / FB45



S	A	**		ACTION ..... REV/DIR
S	P	G	**	PROPORTIONAL GAIN ..... 0.01 to 100.00
S	T	I	**	TIME - INTEGRAL ..... 0.01 to 1000.00
S	T	D	**	TIME - DERIVATIVE ..... 0.00 to 100.00
S	D	G	**	DERIVATIVE GAIN .....1.00 to 30.00
S	M	R	**	MANUAL RESET ..... 0.0 to 100.0%
S	H	L	**	HIGH OUTPUT LIMIT..... -10.00 to 110.00%
S	L	L	**	LOW OUTPUT LIMIT ..... -10.00 to 110.00%
H	C	**	T	CONTROLLER TYPE ..... PID/PD/ID/PIDA
H	M	R	T	MANUAL RESET TRACKING ..... NO/YES
H	I	N	P	INPUT P (PROCESS) ..... 00 to 99
H	I	N	S	INPUT S (SETPOINT) ..... 00 to 99
H	I	N	F	INPUT F (FEEDBACK) ..... 00 to 99
H	I	N	A	INPUT A (ADAPTIVE GAIN) ..... 00 to 99
H	I	N	C	INPUT C (TRACK COMMAND) ..... 00 to 99

* See Output Identifications
** If Controller #1: 1, If Controller #2: 2

(continued on next page)

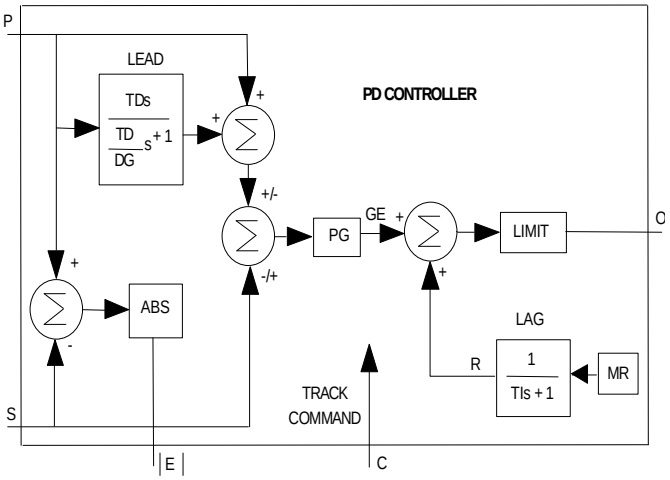
Equations

$$O = GE + R$$

NORMAL (C=0%) $R = \frac{MR}{TIs + 1}$

TRACK (C=100%) $R = F - GE$

IF MRT = YES $MR = F$



BLOCK DIAGRAM

Controller Initialization

Power Up: The controller will initialize with an output of 0% unless FB14 for Loop 1 or FB55 for Loop 2 was configured to power up in Auto and at the last value. In this case the controller will track for two scan cycles to insure that the output will be set equal to the feedback. In most cases the feedback will be the output of FB14 for Loop 1 or FB55 for Loop 2 which under these conditions has held the output value prior to a loss in power.

Switch Transfer: The controller will eliminate any proportional gain action on the first scan cycle after a transfer switch (i.e. FB11, FB23, FB49, FB71) has changed position. This prevents any output bump that could occur due to an abrupt change in the setpoint.

8.8.3 ID CONTROLLER #1/#2 FB13/FB45

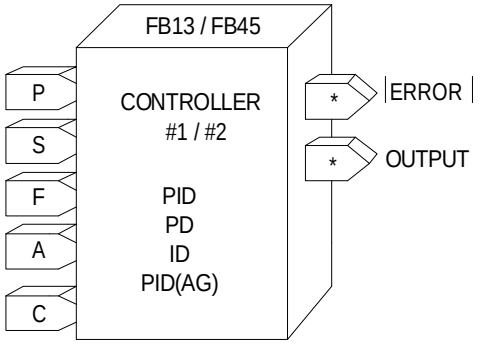
ID Controller #1 and #2: ID Controller #1 and #2 is an integral only controller using external feedback to establish integral action. External feedback is necessary to permit interaction with internal function blocks or external devices (e.g. secondary controller, override controller, shutoff valve, ...), pneumatic or electronic, while eliminating windup that can occur with other controller types. This controller is associated with Loop 1 and Loop 2 functions respectively.

Input C 'Track Command' when high (>=80%) will force the controller output to track Input F 'Feedback'. While in the tracking mode the feedback value will be limited to the output limit settings, so that the controller output will also not exceed these values. The controller will return to normal when Input C goes low (<75%).

The Gain for this controller is fixed at 1.00. While the parameter PG can be changed, it will not affect the controller gain. When the Derivative Time is set to 0.00 the derivative action is eliminated.

Note: Time-Integral set in minutes/repeat.
Time Derivative set in minutes.

CONTROLLER #1 / #2
FB13 / FB45



S	A	**		ACTION ..... REV/DIR
S	P	G	**	PROPORTIONAL GAIN ..... 0.01 to 100.00
S	T	I	**	TIME - INTEGRAL ..... 0.01 to 1000.00
S	T	D	**	TIME - DERIVATIVE ..... 0.00 to 100.00
S	D	G	**	DERIVATIVE GAIN .....1.00 to 30.00
S	M	R	**	MANUAL RESET ..... 0.0 to 100.0%
S	H	L	**	HIGH OUTPUT LIMIT..... -10.00 to 110.00%
S	L	L	**	LOW OUTPUT LIMIT ..... -10.00 to 110.00%
H	C	**	T	CONTROLLER TYPE ..... PID/PD/ID/PIDA
H	M	R	T	MANUAL RESET TRACKING ..... NO/YES
H	I	N	P	INPUT P (PROCESS) ..... 00 to 99
H	I	N	S	INPUT S (SETPOINT) ..... 00 to 99
H	I	N	F	INPUT F (FEEDBACK) ..... 00 to 99
H	I	N	A	INPUT A (ADAPTIVE GAIN) ..... 00 to 99
H	I	N	C	INPUT C (TRACK COMMAND) ..... 00 to 99

* See Output Identifications
** If Controller #1: 1, If Controller #2: 2

FB Number	Output Identifications
13	Controller Output: 14 |ERROR| Signal: 15
45	Controller Output: 46 |ERROR| Signal: 47

(continued on next page)

Equations

NORMAL (C=0%)

$$O = \frac{GE + F}{TIs + 1}$$

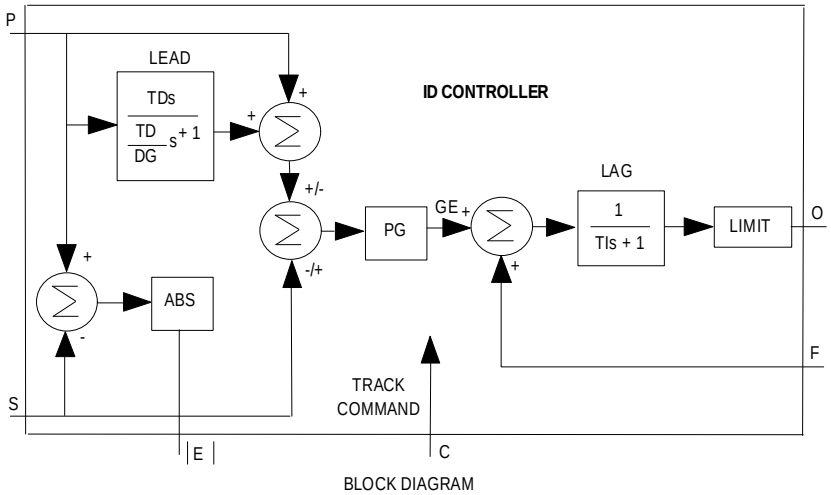
WHEN CONTROLLER OUTPUT IS CONNECTED TO THE FEEDBACK

$$O = +/- PG \left[P \left[1 + \frac{TDs}{(TD/DG)s + 1} \right] - S \right] \left[\frac{1}{TIs} \right]$$

TRACK (C=100%) O = F

Controller Initialization

Power Up: The controller will initialize with an output of 0% unless FB14 for Loop 1 or FB55 for Loop 2 was configured to power up in Auto and at the last value. In this case the controller will track for two scan cycles to insure that the output will be set equal to the feedback. In most cases the feedback will be the output of FB14 for Loop 1 or FB55 for Loop 2 which under these conditions has held the output value prior to a loss in power.



BLOCK DIAGRAM

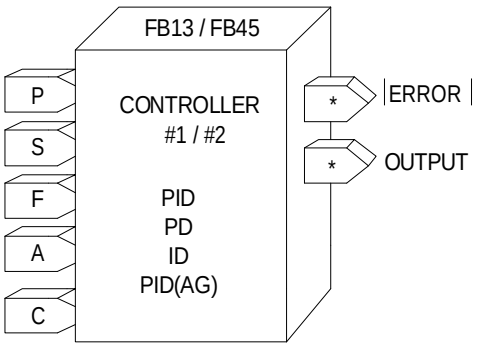
8.8.4 PIDA CONTROLLER #1/#2 FB13/FB45

PIDA Controller #1 and #2: PIDA (PID with Adaptive Gain) Controller #1 and #2 is similar to the PID except that a multiplier is placed after the proportional gain section. The gain of this multiplier varies from 0-1 as Input A varies from 0-100%. If Input A is not configured the gain is set to 1 and the controller is identical to the standard PID. This controller is associated with Loop 1 and Loop 2 functions respectively.

FB NUMBER	Output Identifications
13	Controller Output: 14 |ERROR| Signal: 15
45	Controller Output: 46 |ERROR| Signal: 47

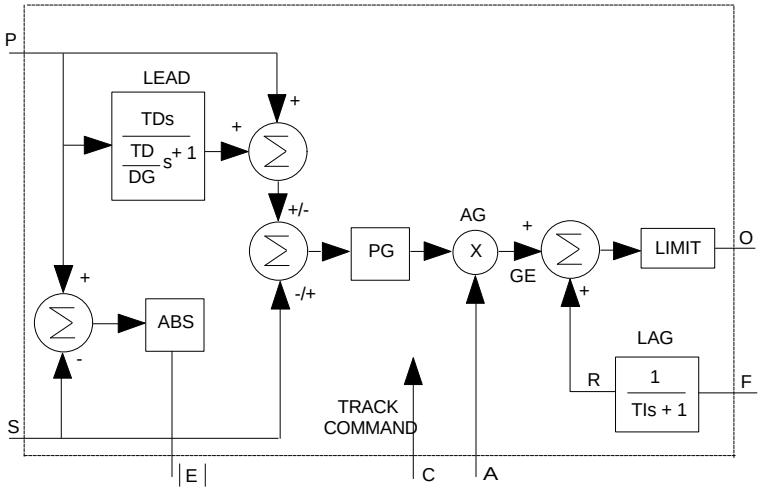
Note:
Time-Integral set in minutes/repeat.
Time Derivative set in minutes.

CONTROLLER #1 / #2
FB13 / FB45



S	A	**		ACTION ..... REV/DIR
S	P	G	**	PROPORTIONAL GAIN ..... 0.01 to 100.00
S	T	I	**	TIME - INTEGRAL ..... 0.01 to 1000.00
S	T	D	**	TIME - DERIVATIVE ..... 0.00 to 100.00
S	D	G	**	DERIVATIVE GAIN .....1.00 to 30.00
S	M	R	**	MANUAL RESET ..... 0.0 to 100.0%
S	H	L	**	HIGH OUTPUT LIMIT..... -10.00 to 110.00%
S	L	L	**	LOW OUTPUT LIMIT ..... -10.00 to 110.00%
H	C	**	T	CONTROLLER TYPE ..... PID/PD/ID/PIDA
H	M	R	T	MANUAL RESET TRACKING ..... NO/YES
H	I	N	P	INPUT P (PROCESS) ..... 00 to 99
H	I	N	S	INPUT S (SETPOINT) ..... 00 to 99
H	I	N	F	INPUT F (FEEDBACK) ..... 00 to 99
H	I	N	A	INPUT A (ADAPTIVE GAIN) ..... 00 to 99
H	I	N	C	INPUT C (TRACK COMMAND) ..... 00 to 99

* See Output Identifications
** If Controller #1: 1, If Controller #2: 2



BLOCK DIAGRAM

Equations

$$O = GE + R$$

NORMAL (C=0%) $$R = \frac{F}{TIs + 1}$$

WHEN CONTROLLER OUTPUT IS CONNECTED TO THE FEEDBACK

$$O = +/- PG \times AG \left[P \left[1 + \frac{TDs}{(TD/DG)s + 1} \right] - S \right] \left[1 + \frac{1}{TIs} \right]$$

TRACK (C=100%) $$R = F - GE \quad \& \quad O = F$$

Controller Initialization

Power Up: The controller will initialize with an output of 0% unless FB14 for Loop 1 or FB55 for Loop 2 was configured to power up in Auto and at the last value. In this case the controller will track for two scan cycles to insure that the output will be set equal to the feedback. In most cases the feedback will be the output of FB14 for Loop 1 or FB55 for Loop 2 which under these conditions has held the output value prior to a loss in power.

Switch Transfer: The controller will eliminate any proportional gain action on the first scan cycle after a transfer switch (i.e. FB11, FB23, FB49, FB71) has changed position. This prevents any output bump that could occur due to an abrupt change in the setpoint.

8.9. TRANSFER

8.9.1 A/M TRANSFER #1/#2 FB14/FB55

A/M Transfer #1and #2 function blocks each consist of 3 SPDT switches. Switch 1 is controlled by the A/M pushbutton on the operator's display. Switch 2 is controlled by Input E 'Emergency Manual' and will be connected to the Manual when Input E is high (>=80%) and will return to its' normal position when Input E goes low (<75%). Switch 3 is controlled by Input S 'Standby Sync' and will be connected to Input T when Input S is high (>=80%) and will return to its' normal position when low (<75%). Neither Emergency Manual or Standby Sync will affect the operation of the A/M pushbutton and its' associated LCD indicators.

The Manual Value **M** can be adjusted with the UP & DOWN pushbuttons when it is the block output and the displayed variable is either V (valve), O (output), or P (process). When manual is not the block output, it will track the output value.

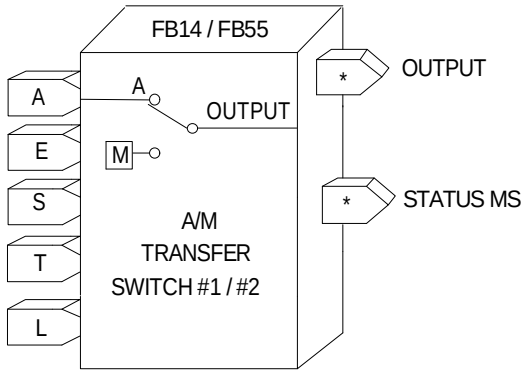
The Loop Control Function, Input L in FB14, is used to control the active A/M block when two loops are used in a single configuration. This function is controlled from FB14 by INL which when INL is High (>=80%) the A/M button and the UP/DOWN buttons are disabled from FB14 and enabled for FB55. When INL goes Low or is not configured these functions are enabled for FB14 and disabled for FB55.

The operator status window will display 'M1' when Input E is high and 'S1' when Input S is high for A/M Transfer #1 and 'M2' & 'S2' for A/M Transfer #2. The operation of the status window is described in Function Block 15.

The function block also has a status output 'MS' that will be high (100%) whenever the block is in manual, emergency manual or standby sync.

(continued on next page)

A/M TRANSFER SWITCH #1 / #2
FB 14 / FB55



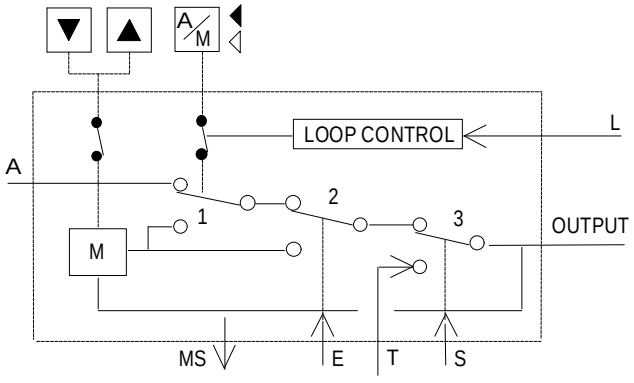
S	P	U	M	
H	A	O		POWER UP MANUAL ..... -10.00 to 110.00%
H	P	U		AUTO ONLY ..... NO/YES
H	P	U	L	POWER UP ..... A/M/LP
H	I	N	A	POWER UP LAST OUTPUT ..... NO/YES
H	I	N	T	INPUT A (AUTO) ..... 00 to 99
H	I	N	E	INPUT T (TRACK VARIABLE) ..... 00 to 99
H	I	N	S	INPUT E (EMERG. MANUAL) ..... 00 to 99
H	I	N	L	INPUT S (STANDBY SYNC) ..... 00 to 99
				INPUT L (LOOP CONTROL) ..... 00 to 99

* See Output Identifications

The A/M transfer can be configured as auto only. When selected, the A/M pushbutton (and switch 1) will always remain in the Auto position. Emergency Manual and Standby Sync will still function normally.

FB Number	Output Identifications
14	Output: 17 Status MS: 18
55	Output: 60 Status MS: 68

Configuration allows for selecting the A/M pushbutton power up position (auto, manual, or last position before power outage). When the function block powers up in manual and **HPUL** is selected as NO, the power up value can be configured for any value from -10% to 110%. When the function block powers up in AUTO or MANUAL and **HPUL** is configured as YES, the output of the block on power up is set to the last value. The block will hold it's output for two scan cycles and the controller will track this value.



BLOCK DIAGRAM

8.9.2 PB TRANSFER #1/#2 FB23/FB11

Transfer Block #1 and #2 consists of 2 SPDT switches. Switch 1 is controlled by PB1 for FB23 and by PB2 for FB11, and can be configured for momentary or sustained action by parameter HS1A. As momentary, switch 1 will transfer to the 'I' position while PB1 or PB2 is pressed and return to 'E' when released. As sustained, switch 1 will transfer to 'I' when PB1 or PB2 is pressed and remain in this position until released and pressed again.

Input A controls switch 2 and will connect to 'I' when Input A is high (>=80%) and then return to the normal position when Input A goes low (<75%). Input A does not affect Switch 1, nor the action of PB2 and its' associated LCD position indicators.

Switch 1 can be configured as 'E Position Only' by setting HEO as YES. In this case the top LCD PB1 or PB2 indicator will remain on and the pushbutton will have no effect on the action of switch 1.

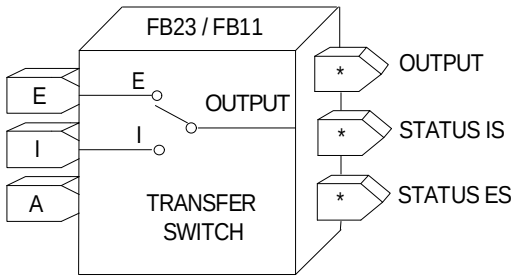
The pushbutton can also be operated by a HART command. Additional information can be found under FB98.

A transfer block can be used to transfer a setpoint to the controller function block. As such, the controller block will initialize on the next execution after a transfer occurs to prevent bumping the controller output.

Two LCD segment indicators are used to indicate the position of PB1 or PB2. These indicators can be disabled by setting the parameter HDSD 'Disable Segment Displays' to YES.

Two status outputs indicate the actual block output. Status 'IS' will be high (100%) when the output is Input I and status 'ES' will be high when the output is Input E.

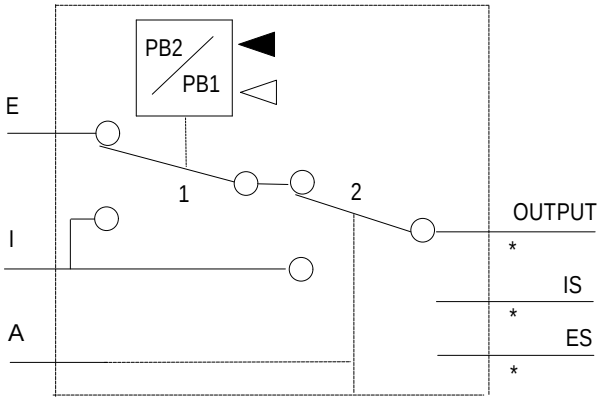
TRANSFER SWITCH
FB23 / FB11



H	E	O		E POSITION ONLY..... NO/YES
H	P	U		POWER UP ..... E/I/LP
H	S	1	A	SWITCH 1 ACTION..... MOM/SUS
H	D	S	D	DISABLE SEGMENT DISPLAYS..... NO/YES
H	I	N	E	INPUT E ..... 00 to 99
H	I	N	I	INPUT I ..... 00 to 99
H	I	N	A	INPUT A ..... 00 to 99

* See Output Identifications

FB Number	Output Identifications
11	Output: 09 Status IS: 10 Status ES: 25
23	Output: 27 Status IS: 63 Status ES: 64



BLOCK DIAGRAM

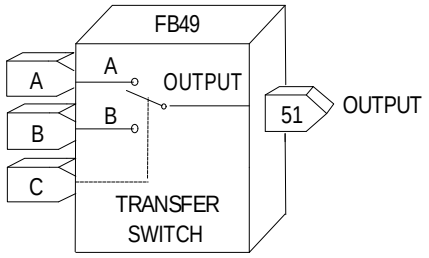
8.9.3 GENERAL PURPOSE TRANSFER FB49

The General Purpose Transfer Switch will select as its output Input A or Input B, depending on the level on Input C.

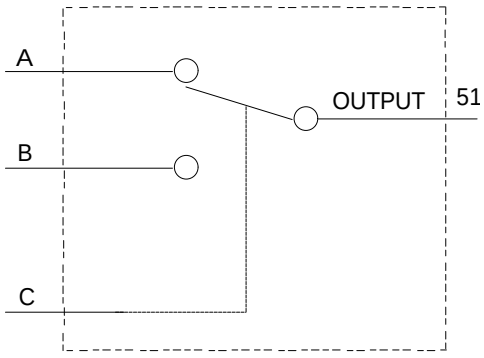
When Input C is high (>=80%), it will transfer to Input B and when low (<75%) will return to Input A.

FB Number	Output Identification
49	Switched Output: 51

GENERAL PURPOSE TRANSFER
FB49



H	I	N	A	INPUT A ..... 00 to 99
H	I	N	B	INPUT B ..... 00 to 99
H	I	N	C	INPUT C (SWITCH COMMAND) ..... 00 to 99



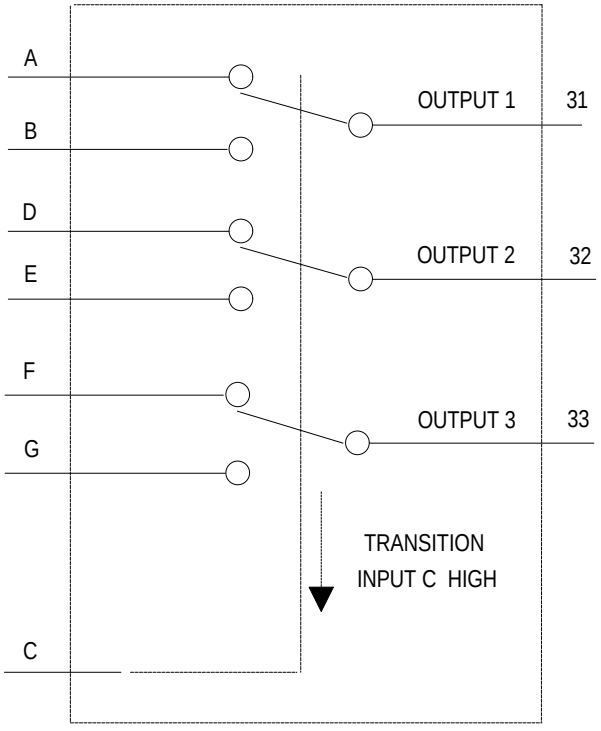
BLOCK DIAGRAM

8.9.4 TRIPLE TRANSFER SWITCH FB71

The Triple Transfer Switch will select INA or INB, IND or INE, and INF or ING as block outputs depending on the level of INC.

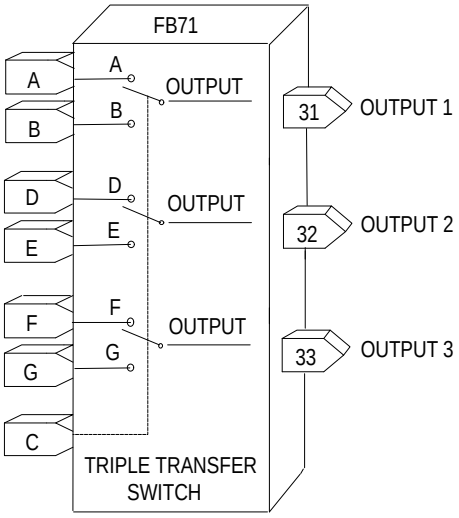
When INC is high (>=80%) the switch will transfer from the normal positions shown in the block diagram. When INC goes low (<75%) or is not configured the switches will return to the normal position.

If INA, IND, or INF are not configured the input values will default to 100%. If INB, INE or ING are not configured the input values will default to 0%.



BLOCK DIAGRAM

TRIPLE TRANSFER SWITCH
FB71



H	I	N	A	INPUT A ..... 00 to 99
H	I	N	B	INPUT B ..... 00 to 99
H	I	N	D	INPUT D ..... 00 to 99
H	I	N	E	INPUT E ..... 00 to 99
H	I	N	F	INPUT F ..... 00 to 99
H	I	N	G	INPUT G ..... 00 to 99
H	I	N	C	INPUT C (SWITCH COMMAND) ..... 00 to 99

FB Number	Inputs	Output Identifications
71	A & B	Output 1: 31
	D & E	Output 2: 32
	F & G	Output 3: 33

8.10 TRACK & HOLD

8.10.1 SETPOINT TRACK & HOLD #1/#2 FB17/FB46

The Setpoint Track & Hold #1 or #2 is generally used to change the setpoint of Controller #1 (FB13) or Controller #2 (FB46) respectively. The hold value of this block can be changed with the UP/DOWN pushbuttons when the displayed variable is S. The block output, however, does not have to be connected to Input S. The hold range of this block is -10.00 to +110.00% but will be displayed in the range of the FB15 input being used for display.

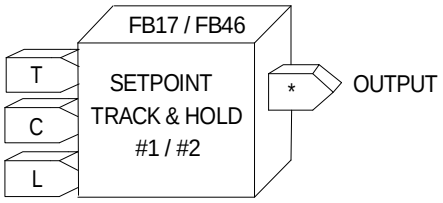
An alternate method, which allows the block hold value to be changed, is to connect the block output (22) for FB17 or (48) for FB46, to the X or Y display variables in FB15. Then, when X or Y is displayed the hold value can be changed using the UP/DOWN pushbuttons.

The function block can be placed in a tracking mode by making Input C high (>=80%). While in the tracking mode the hold value will track Input T. The pushbuttons will have no effect on the hold value in this mode.

Input L is used to control the active Setpoint block when two loops are used in a single configuration. When INL is high (>=80%) the UP/DOWN buttons are disabled from FB17 and enabled for FB46. When INL goes low or is not configured FB17 is enabled and FB46 is disabled.

The Setpoint Track & Hold also has built-in functions that can be initiated using communication commands (e.g. Target Setpoint, Ramp Rate, Ramp Time, Start & Stop ramp action). For more details on accessing these functions, reference FB98 and the appropriate manuals for the HART master used to communicate to the Model 348 (i.e. UM325-1 when communicating through the Model 325 URICA, CG39-7 for the HFM, and CG385-4 for the Model 385 Loop Operator's Station).

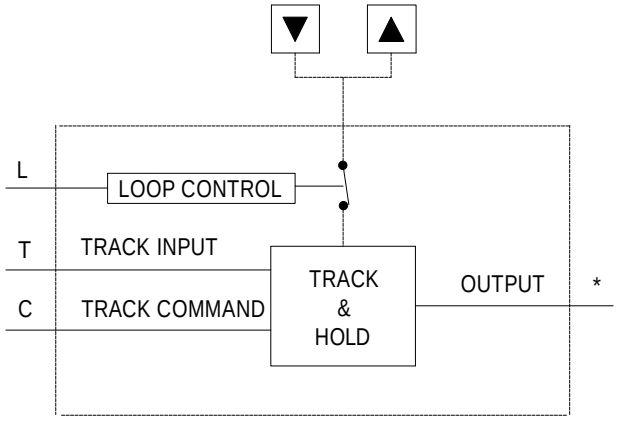
SETPOINT TRACK & HOLD #1 / #2
FB17 / FB46



H	I	N	T	INPUT T (TRACK VARIABLE) ..... 00 to 99
H	I	N	C	INPUT C (TRACK COMMAND) ..... 00 to 99
H	I	N	L	INPUT L (LOOP COMMAND) ..... 00 to 99

* See Output Identifications

FB Number	Output Identification
17	Setpoint Signal Output: 22
46	Setpoint Signal Output: 48



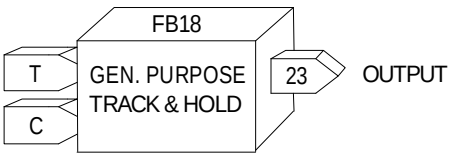
BLOCK DIAGRAM

8.10.2 GENERAL PURPOSE TRACK & HOLD FB18

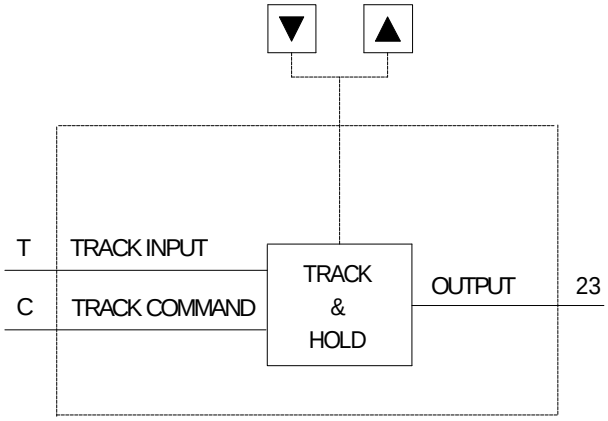
The General Purpose Track & Hold is similar to FB17 except that a hold value (H1) can be entered in soft configuration. The UP/DOWN pushbuttons can also change the hold value if the block output (23) is connected to the X or Y display variables. Then, when X or Y is displayed the value can be changed unless the parameter HHCD 'Hold Value Change Disabled' is set to YES.

FB Number	Output Identification
18	Signal Output: 23

GENERAL PURPOSE TRACK & HOLD FB18



S	H	1		HOLD VALUE ..... -10.00 to +110.00%
H	I	N	T	INPUT T (TRACK VARIABLE) ..... 00 to 99
H	I	N	C	INPUT C (TRACK COMMAND) ..... 00 to 99
H	I	N	D	HV CHANGE DISABLED ..... NO/YES



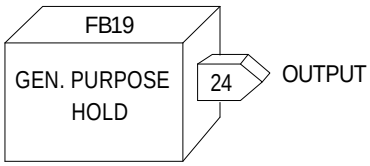
BLOCK DIAGRAM

8.10.3 GENERAL PURPOSE HOLD FB19

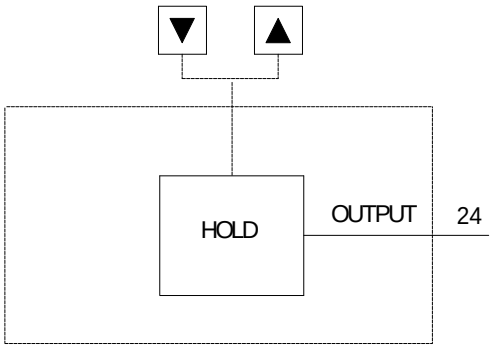
The General Purpose Hold value (H2) can be entered in soft configuration. The UP/DOWN pushbuttons can also change the hold value if the block output (23) is connected to the X or Y display variables. Then, when X or Y is displayed the value can be changed unless the parameter HHCD 'Hold Value Change Disabled' is set to YES.

FB Number	Output Identification
19	Output: 24

GENERAL PURPOSE HOLD
FB19



S	H	2		HOLD VALUE ..... -10.00 to +110.00%
H	H	C	D	HV CHANGE DISABLED ..... NO/YES



BLOCK DIAGRAM

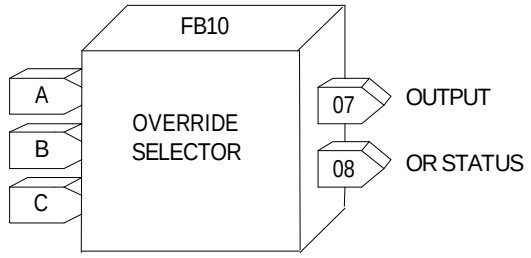
8.11 OVERRIDE SELECTOR FB10

The override selector function block consists of two signal selectors in series. Each can be configured as LO or HI. Whenever the block output is not equal to Input A, the block output 'OR Status' will go high (100%) and the operator display status window, as described in FB15, will display 'OR'.

The 'OR' status will not be displayed in the status window if the configuration parameter HDSD 'Display Status Disabled' is set to YES.

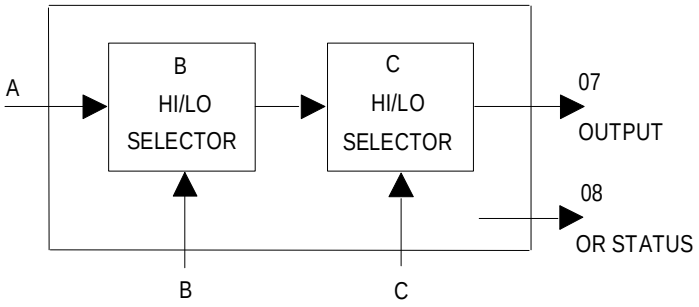
Any selector having only one input will result in that input being the selector output. No inputs will result in an output of 0% and an 'OR' status of 0%.

OVERRIDE SELECTOR
FB10



H	S	1	B	B SELECTOR ..... LO/HI
H	S	1	C	C SELECTOR ..... LO/HI
H	D	S	D	DISPLAY STATUS DISABLED.... ..... NO/YES
H	I	N	A	INPUT A ..... 00 to 99
H	I	N	B	INPUT B ..... 00 to 99
H	I	N	C	INPUT C ..... 00 to 99

FB Number	Output Identifications
10	Signal Output: 07 OR Status: 08



BLOCK DIAGRAM

8.12. LOGIC

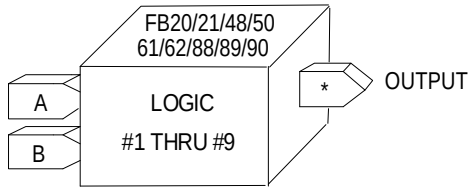
8.12.1 LOGIC BLOCKS #1 THRU #9 FB20/21/48/50/61/62/88/89/90

This function block provides the ability to perform logic operations on a pair of inputs. Functions include AND/NAND/OR/NOR/EXOR (exclusive OR).

Unconfigured inputs for AND/NAND will be set to 100% and OR/NOR/EXOR to 0%.

A logic 1 is a high input (>=80%) and a logic 0 a low (<75%).

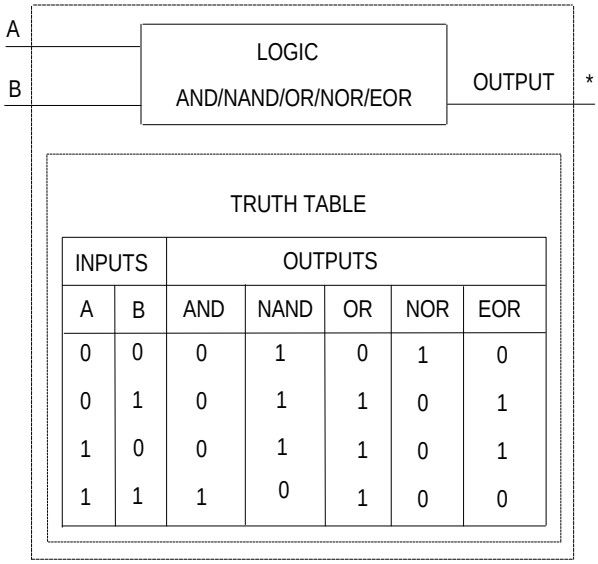
LOGIC BLOCK #1 THRU #9
FB20/21/48/50/61/62/88/89/90



H	I	T	**	LOGIC TYPE ..... AND/NAND/OR/NOR/EOR
H	I	N	A	INPUT A ..... 00 to 99
H	I	N	B	INPUT B ..... 00 to 99

* See Output Identification
** FB20: 1, FB21: 2, FB48: 3, FB50: 4, FB61: 5, FB62: 6, FB88: 7, FB89: 8, FB90: 9

FB Number	Output Identification
20	Logic #1 Signal Output: 20
21	Logic #2 Signal Output: 21
48	Logic #3 Signal Output: 52
50	Logic #4 Signal Output: 53
61	Logic #5 Signal Output: 61
62	Logic #6 Signal Output: 62
88	Logic #7 Signal Output: 65
89	Logic #8 Signal Output: 66
90	Logic #9 Signal Output: 67



TRUTH TABLE

INPUTS		OUTPUTS				
A	B	AND	NAND	OR	NOR	EOR
0	0	0	1	0	1	0
0	1	0	1	1	0	1
1	0	0	1	1	0	1
1	1	1	0	1	0	0

8.12.2 DELAY TIMER FB65

This function block can be configured as an ON-DELAY or OFF-DELAY timer.

ON-DELAY
When Input A is low (<75%), the output is low (0%). If Input A goes high (>=80%), the timer will wait for a delay period DT and will then go high (100%), provided Input A is still high.

OFF-DELAY
When Input A is high (>=80%), the output is high (100%). If Input A goes low (<75%), the timer will wait for a delay period DT and will then go low (0%), provided Input A is still low.

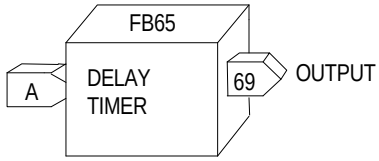
POWER-UP
When OFF-DELAY is selected and Input A is low on power-up, the block can be configured to set its output high (100%) by selecting HOPU = YES. In this case the output will remain high for the delay period DT and then go low, provided Input A is still low.

When ON-DELAY is selected and Input A is high on power-up, the block can be configured to set its output high immediately by selecting HOPU = YES.

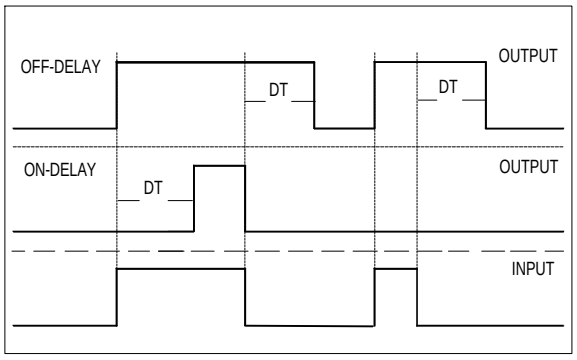
The Delay Time in seconds will be resolved to the closest 0.15 seconds which is the cycle time of the Model 348.

FB Number	Output Identification
65	Timer Output: 69

DELAY TIMER
FB65



S	D	T		DELAY TIME ..... 0.0 to 99999.9 SEC
H	I	N	A	INPUT A ..... 00 to 99
H	D	T	T	DELAY TIMER TYPE ..... OFF/ON
H	O	P	U	OUTPUT POWER-UP @ 100% ..... NO/YES



TIMING DIAGRAM EXAMPLE

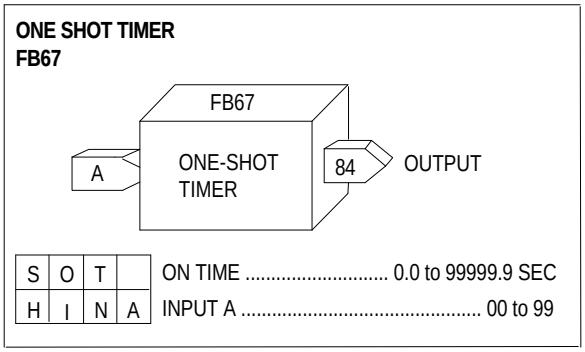
8.12.3 ONE SHOT TIMER FB67

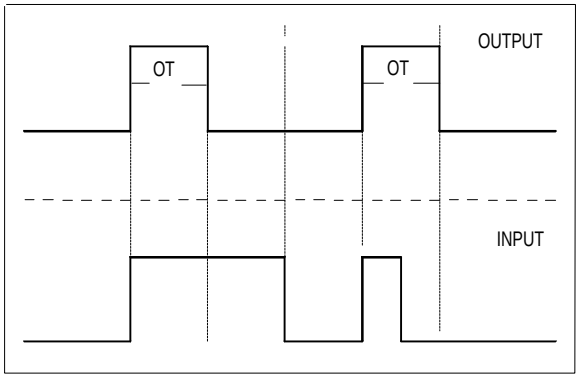
The One Shot Timer output will go high (100%) when Input A makes a positive transition (i.e. goes from low to high). If another positive transition is made while the timer output is still high, the timer will restart. The output will then remain high for a period equal to OT 'On Time'. The output will go low (0%) after the OT period until a new positive transition occurs.

An input is considered high when equal to or greater than 80%.

The configuration time 'OT' will be resolved to the closest 0.15 seconds which is the cycle time of the Model 348.

FB Name	**Output Identification**
67	Timer Output: 84





TIMING DIAGRAM EXAMPLE

8.12.4 REPEAT CYCLE TIMER FB47

Start
When Input B goes high (>=80%), the timer output will go from 0% to 100% and remain there for time TN, at which time the output returns to 0% for time TF. When TF is set to 0.00 the output will not turn off but stay on indefinitely. The timer will continue to repeat this cycle until stopped.

Stop
When Input B goes low (<75%), the timer output immediately goes to 0%.

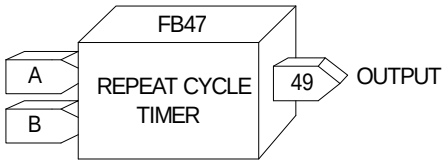
Adaptive On Time
The Adaptive On Time function is only active when Input A is configured. There are two separate applications for this function:

When TF is set to 0.00 the TIME PERIOD will remain fixed and equal to TN. The ON time will vary from 0 to TN as Input A goes from 0% to 100%.

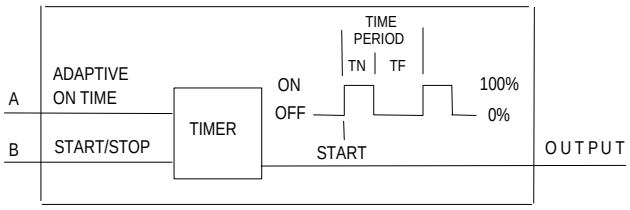
When TF is set at a value greater than 0.00 the OFF time will remain fixed at that value and the ON time will vary from 0 to TN as Input A goes from 0% to 100%.

FB Number	Output Identification
47	Repeat Cycle Signal: 49

REPEAT CYCLE TIMER
FB47



S	T	F		TIME- OFF ..... 0.00 to 9999.99 MIN
S	T	N		TIME- ON ..... 0.00 to 9999.99 MIN
H	I	N	A	INPUT A (ADAPTIVE ON TIME) ..... 00 to 99
H	I	N	B	INPUT B (START) ..... 00 to 99



BLOCK DIAGRAM

8.13 RATIO & BIAS

8.13.1 RATIO FB07

The RATIO block multiplies two block inputs A&B by R (Ratio). All 0-100% block input signals have a real range of 0-1, and the resultant 0-1 computed range represents a 0-100% block output. The output of the Ratio block is not limited.

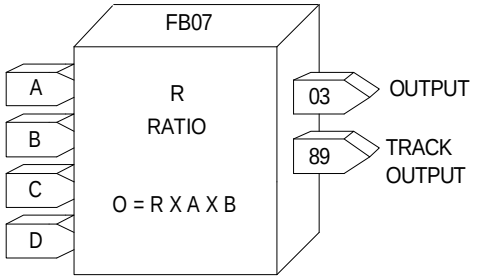
When Input C is high (>=80%), the output will track Input D and the R (Ratio) value will be recalculated as R=D/(AxB). R is limited to the values of the Ratio Range established in configuration. Any calculated value of R exceeding these limits will be clamped at the limit.

Parameter SR 'Ratio' will be limited within the configured Ratio Range. Also SRRL 'Ratio Range Low' can not be set higher than SR and SRRH 'Ratio Range High' can not be set lower than SR.

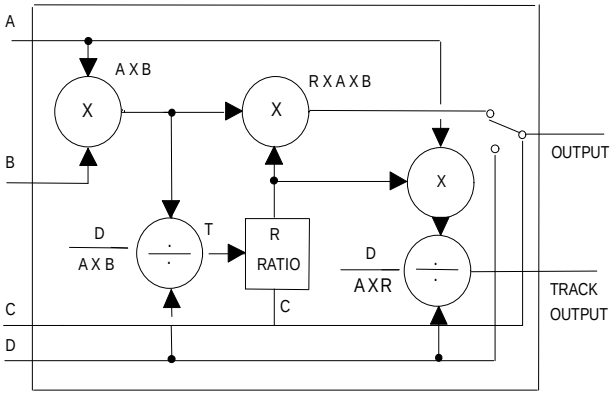
The Ratio value can be viewed using the D button if FB07 was selected in the T mode. The Ratio value can be changed continuously with the UP/DOWN arrow keys unless the Ratio Change Disabled parameter was configured as YES.

FB Number	Output Identification	Unused Inputs (Defaults)
07	Ratio Output Signal:03 Track Output: 89	Input A = 100% (1.0) Input B = 100% (1.0) Input C = 0% (0.0) Input D = 100% (1.0)

RATIO
FB07



S	R			RATIO .....0.00 to 30.00
S	R	R	L	RATIO RANGE LOW ..... 0.00 to 30.00
S	R	R	H	RATIO RANGE HIGH ..... 0.00 to 30.00
H	I	N	A	INPUT A ..... 00 to 99
H	I	N	B	INPUT B ..... 00 to 99
H	I	N	C	INPUT C ..... 00 to 99
H	I	N	D	INPUT D ..... 00 to 99
H	R	C	D	RATIO CHANGE DISABLED ..... NO/YES



BLOCK DIAGRAM

8.13.2 BIAS FB08

The BIAS block sums input signals A and E together with the BIAS value B. The output of the Bias block is not limited.

When Input C is high (>=80%), the output will track Input D and the B (Bias) value will be recalculated as B=D-(A+E). The value of B is limited to +/-150% and any calculated Bias value exceeding these limits will be clamped at a limit.

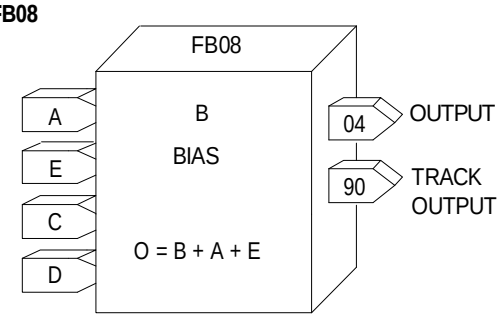
The Bias value can be viewed using the D button if FB08 was selected in the T mode. The Bias value can be changed continuously using the UP/DOWN arrow keys unless the Bias Change Disabled parameter was configured as YES.

The Bias value that is viewed using the D pushbutton (i.e. Operator Bias Range) can have an associated engineering range, selectable from one of the ranges configured in FB15. For example, it may be preferable to view the Bias value in Process units in place of % of range if it is the setpoint to the controller. The selectable ranges are defined as follows:

1 ..... P1
2 ..... P2
3 X
4 ..... Y
5 ..... %

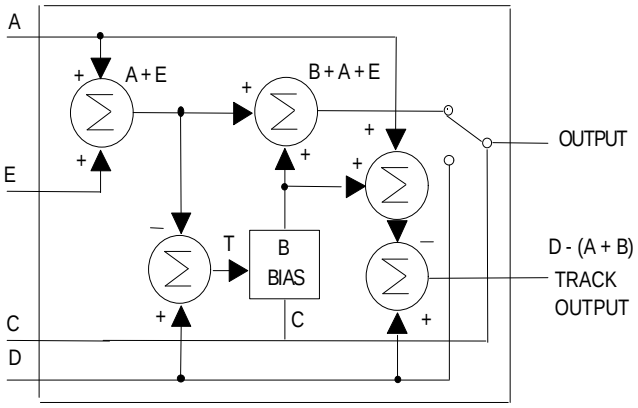
FB Number	Output Identification	Unused Inputs
08	Bias Output Signal: 04 Track Output: 90	Input A: 0% Input E: 0% Input C: 0% Input D: 0%

BIAS
FB08



S	B		
H	O	B	R
H	I	N	A
H	I	N	E
H	I	N	C
H	I	N	D
H	B	C	D

BIAS ..... -150.00% to +150.00%
OPERATOR BIAS RANGE 1/2/3/4/5
INPUT A ..... 00 to 99
INPUT E ..... 00 to 99
INPUT C ..... 00 to 99
INPUT D ..... 00 to 99
BIAS CHANGE DISABLED ..... NO/YES



BLOCK DIAGRAM

8.14 HI/LO SETPOINT LIMIT #1/#2 FB09/FB51

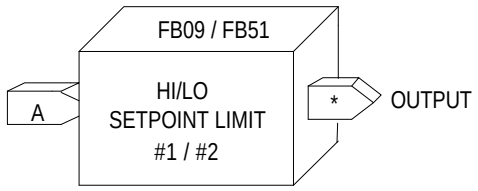
The HI/LO Setpoint Limit block accepts a block interconnection signal and provides an output that is limited within the high (HL) and low (LL) limit settings. This block is normally used as a limit for the setpoint to the Loop 1 controller (FB13 for FB09) or Loop 2 Controller (FB45 for FB51), and will be reported in the HART communications as part of the Loop 1 or Loop 2 setpoint information. Note that when the Setpoint display is configured to be the output of the Limit block, pressing the UP/DOWN arrows while the Setpoint is selected changes the output of the Setpoint block, not the output of the Limit block. The setpoint block output continues to change even though the limit block (FB09/54) limits the output and the displayed setpoint. This block can be used for other than setpoint limiting noting that the limit values and status will be reported as part of the Loop 1 and Loop 2 information.

The status of this block can be displayed in the 4 character status window as described in FB15. When the output is equal to the high limit setting, the alphanumeric will display H1 for FB09 or H2 for FB51. When the output is equal to the low limit setting the alphanumeric will display L1 for Loop1 or L2 for Loop2.

When a Hi Limit is set lower than a Lo Limit the block output will equal the Hi Limit.

The alphanumeric statuses will not be displayed in the status window if the configuration parameter HDSD is set to YES.

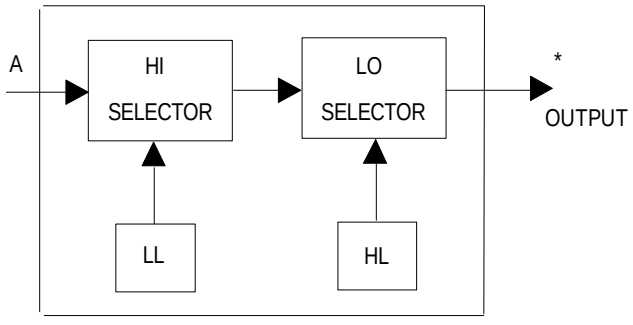
HI/LO SETPOINT LIMIT #1 /#2
FB09 / FB51



S	L	L	**	LOW LIMIT ..... -10.00% to +110.00%
S	H	L	**	HIGH LIMIT ..... -10.00% to +110.00%
H	D	S	D	DISPLAY STATUS DISABLED ..... NO/YES
H	I	N	A	INPUT A ..... 00 to 99

* See Output Identifications
** FB09: 1, FB51: 2

FB Number	Output Identifications
09	05
51	54



BLOCK DIAGRAM

8.15 ALARMS

8.15.1 ALARM BLOCK #1/#2 FB12/FB73

Alarm Block #1 and #2 each contain four alarms. This block normally associates with alarms that are part of Loop 1 (i.e. Controller #1 and Setpoint #1) and Loop 2 (i.e. Controller #2 and Setpoint #2).. Each alarm may be configured as an absolute or deviation type alarm. The action of each alarm can be selected as a **HI, LO, HDEV, LDEV, DEV, OR** or **NONE** during Hard configuration.

HI or **LO** will function as a high or low absolute alarm that compares the input with Setpoint SSA_. When the input (A,B,C,D) is higher than the Setpoint for a Hi alarm or lower than the Setpoint for a Lo alarm, the block output Status AS_ will go high (100%).

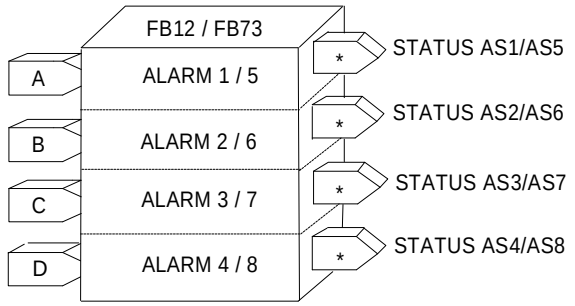
OR (out of range) will function as a high and low absolute alarm. The setpoints for this alarm are fixed at 0% and 100%, and the SSA_ parameters are ignored.

HDEV or **LDEV** will function as a high or low difference alarm between two inputs for Loop #1(Inputs A & B if alarm 1 or 2 is selected, Inputs C & D if alarm 3 or 4 is selected) or Loop #2 (Inputs A & B if alarm 5 or 6 is selected, Inputs C & D if alarm 7 or 8 is selected). Note, when alarm 1 is selected, alarm 2 can still be used as a **HI, LO,** or **OR** using Input B.

DEV will function as an absolute difference alarm between the corresponding inputs for Loop #1(Inputs A & B if alarm 1 or 2 is selected, Inputs C & D if alarm 3 or 4 is selected) or Loop #2 (Inputs A & B if alarm 5 or 6 is selected, Inputs C & D if alarm 7 or 8 is selected).

(continued on next page)

ALARM BLOCK #1 / #2
FB12 / FB73



S	S	A	**	SETPOINT ALARM 1/5 ..... -10.00 to 110.00%
S	S	A	**	SETPOINT ALARM 2/6 ..... -10.00 to 110.00%
S	S	A	**	SETPOINT ALARM 3/7 ..... -10.00 to 110.00%
S	S	A	**	SETPOINT ALARM 4/8 ..... -10.00 to 110.00%
S	D	A	**	DEADBAND ALARM 1/5 ..... 0.1/0.5/1/5%
S	D	A	**	DEADBAND ALARM 2/6 ..... 0.1/0.5/1/5%
S	D	A	**	DEADBAND ALARM 3/7 ..... 0.1/0.5/1/5%
S	D	A	**	DEADBAND ALARM 4/8 ..... 0.1/0.5/1/5%
S	E	A	**	ENABLE/DISABLE ALARM 1/5 ..... EN/DIS
S	E	A	**	ENABLE/DISABLE ALARM 2/6 ..... EN/DIS
S	E	A	**	ENABLE/DISABLE ALARM 3/7 ..... EN/DIS
S	E	A	**	ENABLE/DISABLE ALARM 4/8 ..... EN/DIS
H	Q	**	R	QUICK ALARM 1/5 RANGE P-1/2-X/3-Y/4-%
H	Q	**	R	QUICK ALARM 2/6 RANGE P-1/2-X/3-Y/4-%
H	Q	**	R	QUICK ALARM 3/7 RANGE P-1/2-X/3-Y/4-%
H	Q	**	R	QUICK ALARM 4/8 RANGE P-1/2-X/3-Y/4-%
H	A	**	T	A1T/A5T .... NONE/HI/LO/HDEV/LDEV/DEV/OR
H	A	**	T	A2T/A6T .... NONE/HI/LO/HDEV/LDEV/DEV/OR
H	A	**	T	A3T/A7T .... NONE/HI/LO/HDEV/LDEV/DEV/OR
H	A	**	T	A4T/A8T .... NONE/HI/LO/HDEV/LDEV/DEV/OR
H	I	N	A	INPUT A ..... 00 to 99
H	I	N	B	INPUT B ..... 00 to 99
H	I	N	C	INPUT C ..... 00 to 99
H	I	N	D	INPUT D ..... 00 to 99
H	A	**	I	A1/A5 DELAY IN ..... 0/.4/1/2/5/15/30/60 SEC
H	A	**	I	A2/A6 DELAY IN ..... 0/.4/1/2/5/15/30/60 SEC
H	A	**	I	A3/A7 DELAY IN ..... 0/.4/1/2/5/15/30/60 SEC
H	A	**	I	A4/A8 DELAY IN ..... 0/.4/1/2/5/15/30/60 SEC
H	A	**	O	A1/A5 DELAY OUT ..... 0/.4/1/2/5/15/30/60 SEC
H	A	**	O	A2/A6 DELAY OUT ..... 0/.4/1/2/5/15/30/60 SEC
H	A	**	O	A3/A7 DELAY OUT ..... 0/.4/1/2/5/15/30/60 SEC
H	A	**	O	A4/A8 DELAY OUT ..... 0/.4/1/2/5/15/30/60 SEC
H	A	**	R	ALARM 1/5 RINGBACK ..... NO/YES
H	A	**	R	ALARM 2/6 RINGBACK ..... NO/YES
H	A	**	R	ALARM 3/7 RINGBACK ..... NO/YES
H	A	**	R	ALARM 4/8 RINGBACK ..... NO/YES

* See Output Identifications
** If Loop1: 1, 2, 3, 4 If Loop 2: 5, 6, 7, 8

The Status of each alarm will be displayed in the status window. The operation of the status window is described in detail as part of FB15.

Each alarm can be Enabled or Disabled using the appropriate SEA_ parameter. When an alarm is disabled its' status output, status window, and flasher (if configured) will be disabled.

Each alarm can have associated engineering units P1, X, Y, or %, which can be selected during configuration by setting parameter HQ_R to 1, 2, 3, or 4 respectively. When an alarm is selected with the Quick Alarm pushbutton, the 4 character alphanumeric display will flash between the alarm mnemonic (e.g. SSA1) for 2 sec. and the associated engineering units (e.g. GPM) for 1 sec.

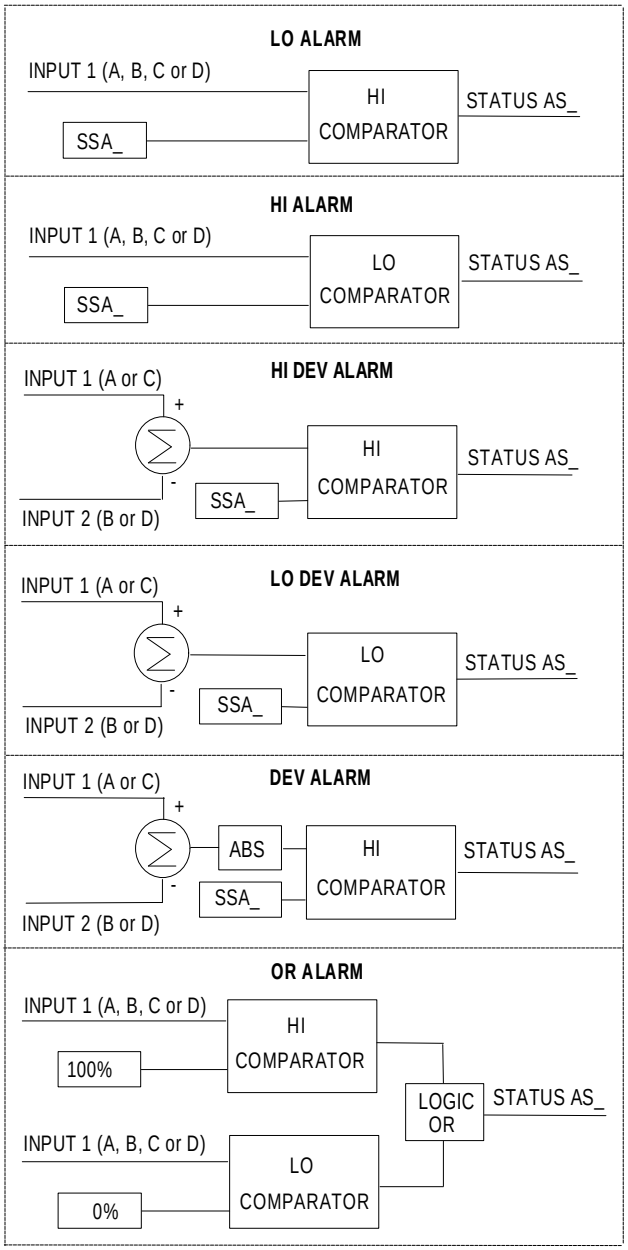
FB Number	**Output Identification**
12	Alarm 1 Status AS1: 11 Alarm 2 Status AS2: 12 Alarm 3 Status AS3: 13 Alarm 4 Status AS4: 91
73	Alarm 5 Status AS5: 75 Alarm 6 Status AS6: 76 Alarm 7 Status AS7: 77 Alarm 8 Status AS8: 78

All alarms have the following features:

Selectable Deadband, requires that the input signal drop below (or above) the setpoint by the amount of the deadband before the alarm clears (goes low).

Dely-In Time, requires that the input signal remain above (or below) the setpoint for the delay time before the alarm trips (goes high).

Delay-Out Time, requires that the input signal remain below (or above) the setpoint + deadband for the delay time before the alarm clears (goes low).



BLOCK DIAGRAM

Ringback, causes a previously acknowledged flashing alarm to flash again when the alarm clears (goes low).

8.15.2 QUAD COMPARATOR FB64

This block provides 4 Comparators that compare an input signal with a trippoint and provide an ON/OFF output. Each comparator also includes configurable deadband (DB).

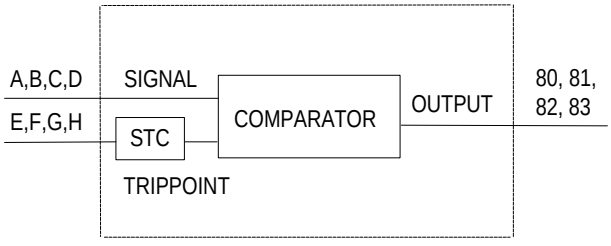
The trippoint of each comparator can be either an input (i.e. E,F,G,H) or parameter STC_. If the input is not configured, STC_ will be compared to the signal input, otherwise the configured input will be used.

Equations

Direct Acting:
I>=TP O = 100%
I<(TP-DB) O = 0%
(TP-DB)>=I<TP O = (no change)

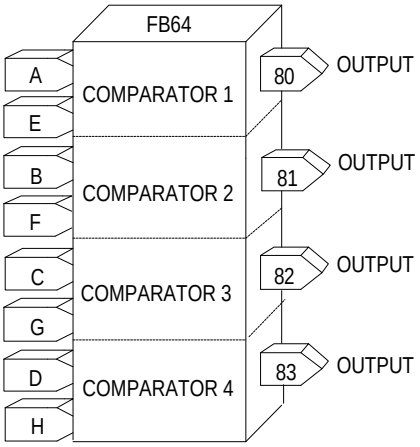
Reverse Acting:
I<=TP O = 100%
I>(TP+DB) O = 0%
(TP+DB)>=I>TP O = (no change)

FB Number	Comparator Number	Input	Output Identification
64	1	A & E	80
	2	B & F	81
	3	C & G	82
	4	D & H	83



BLOCK DIAGRAM

QUAD COMPARATOR
FB64



S	T	C	1	TRIP COMP. 1 ..... -10.00 to 110.00%
S	T	C	2	TRIP COMP. 2 ..... -10.00 to 110.00%
S	T	C	3	TRIP COMP. 3 ..... -10.00 to 110.00%
S	T	C	4	TRIP COMP. 4 ..... -10.00 to 110.00%
S	D	C	1	DEADBAND COMP. 1 ..... 0.1 to 100.0%
S	D	C	2	DEADBAND COMP. 2 ..... 0.1 to 100.0%
S	D	C	3	DEADBAND COMP. 3 ..... 0.1 to 100.0%
S	D	C	4	DEADBAND COMP. 4 ..... 0.1 to 100.0%
H	C	1	A	COMP. 1 ACTION ..... REV/DIR
H	C	2	A	COMP. 2 ACTION ..... REV/DIR
H	C	3	A	COMP. 3 ACTION ..... REV/DIR
H	C	4	A	COMP. 4 ACTION ..... REV/DIR
H	I	N	A	INPUT A ..... 00 to 99
H	I	N	B	INPUT B ..... 00 to 99
H	I	N	C	INPUT C ..... 00 to 99
H	I	N	D	INPUT D ..... 00 to 99
H	I	N	E	INPUT E ..... 00 to 99
H	I	N	F	INPUT F ..... 00 to 99
H	I	N	G	INPUT G ..... 00 to 99
H	I	N	H	INPUT H ..... 00 to 99

8.16 OPERATOR'S DISPLAY FB15

The Operator Display function block controls the function of the operator display panel on the front of the Model 348.

Pushbuttons

PB1 - Active when FB23 has been selected in the T mode. See function block description for operational details.

PB2 - Active when FB11 has been selected in the T mode. See function block description for operational details.

A/M - Active when FB14 and/or FB55 has been selected in the T mode. It will toggle the controller between Auto & Manual as detailed in FB14 or FB55 description. It interfaces with FB55 when the Loop Command activates the block. The upper LCD segment indicates Auto and the lower segment Manual.

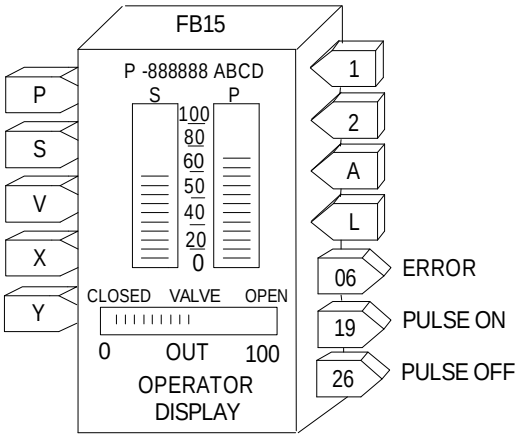
D - This pushbutton is used to change the displayed variable. A single alphanumeric character will indicate the displayed variable as P, S, V/O, X, Y, R, B, C, M, 1, or 2. The units, if applicable, for each of these will be displayed in the four character alphanumeric display.

ACK - This pushbutton, when not in the configuration mode will acknowledge a flashing alarm or status and open the status window showing the condition being acknowledged.

Repeated pressing of this button will step through and acknowledge other statuses, if present. If this button is not pressed, for 5 seconds, the four character display will return to its' normal function of displaying the engineering units of the displayed variable.

(continued on next page)

OPERATORS DISPLAY
FB15



S	D	P	1	DECIMAL POINT RANGE 1 ..... .0.0.0.0.0.0
S	P	L	1	PROCESS LO RANGE 1 ..... +/- 0 to 999999
S	P	H	1	PROCESS HI RANGE 1 ..... +/- 0 to 999999
S	D	P	2	DECIMAL POINT RANGE 2 ... . .0.0.0.0.0.0
S	P	L	2	PROCESS LO RANGE 2 ..... +/- 0 to 999999
S	P	H	2	PROCESS HI RANGE 2 ..... +/- 0 to 999999
S	D	P	X	DECIMAL POINT X 0.0.0.0.0.0
S	X	L		X LO RANGE ..... +/- 0 to 999999
S	X	H		X HI RANGE ..... +/- 0 to 999999
S	D	P	Y	DECIMAL POINT Y 0.0.0.0.0.0
S	Y	L		Y LO RANGE ..... +/- 0 to 999999
S	Y	H		Y HI RANGE ..... +/- 0 to 999999
S	T	S	T	TAG SCROLL TIME ..... 5 to 20 SEC
S	T	S	I	TAG SCROLL INFO TN1/TN2/BOTH
H	I	N	P	INPUT P (PROCESS) ..... 00 to 99
H	I	N	S	INPUT S (SETPOINT) ..... 00 to 99
H	I	N	V	INPUT V (VALVE/OUTPUT) ..... 00 to 99
H	I	N	X	INPUT X ..... 00 to 99
H	I	N	Y	INPUT Y ..... 00 to 99
H	I	N	A	INPUT A (ACKNOWLEDGE) ..... 00 to 99
H	I	N	L	INPUT L (LOOP SELECT) ..... 00 to 99
H	P	D	R	PROCESS DISPLAY RANGE 1/2/L
H	S	D	R	SETPOINT DISPLAY RANGE 1/2/L
H	H	S	1	HORIZONTAL-BAR SELECT 1 ..... V/O
H	H	S	2	HORIZONTAL-BAR SELECT 2 ..... V/O
H	H	D	1	HORIZONTAL-BAR DIRECT 1 ..... NO/YES
H	H	D	2	HORIZONTAL-BAR DIRECT 2 ..... NO/YES

(cont'd on next page)

H	S	C	F	SELF CLEARING FLASHER ..... NO/YES
H	I	N	1	INPUT 1 (USER 1 STATUS) ..... 00 to 99
H	I	N	2	INPUT 2 (USER 2 STATUS) ..... 00 to 99
H	U	1	S	USER 1 STATUS ..... 2 CHAR (ASCII)
H	U	2	S	USER 2 STATUS ..... 2 CHAR (ASCII)
H	T	N	1	TAG NAME PROCESS 1 ..... 12 CHAR (ASCII)
H	T	N	2	TAG NAME PROCESS 2 ..... 12 CHAR (ASCII)
H	E	U	1	ENG. UNITS PROCESS 1 ..... 4 CHAR (ASCII)
H	E	U	2	ENG. UNITS PROCESS 2 ..... 4 CHAR (ASCII)
H	E	U	X	ENG. UNITS X ..... 4 CHAR (ASCII)
H	E	U	Y	ENG. UNITS Y ..... 4 CHAR (ASCII)
H	F	L	1	FLASHER 1 ..... (see table 1)
H	F	L	2	FLASHER 2 ..... (see table 1)
H	F	L	3	FLASHER 3 ..... (see table 1)
H	F	L	4	FLASHER 4 ..... (see table 1)
H	F	L	5	FLASHER 5 ..... (see table 1)

TAG - This button, when not in the configuration mode, will cause the 4 character display to scroll, displaying the following information as defined by parameter 'STSI':

a) Tag Name 1 <Loop 1>
b) Tag Name 2 <Loop 2>
c) Tag Name 1/Tag Name 2

Configuration Pushbuttons: These buttons are described in the configuration section of this manual. This also includes the Quick Access buttons such as ALARM, ...

Status Window: The four character display normally indicates the engineering units of the displayed variable. When a status condition occurs it will stack up behind the engineering units and can be viewed by the operator using the ACK pushbutton. The four decimal points in the display window will blink when a status is present. This indicates that the window can be opened using the ACK button to view the statuses. While viewing statuses the blinking will stop. If the ACK button is not pressed for 5 seconds the window will close,

(continued on next page)

again displaying any engineering units and blinking the decimal points as long as any statuses are present.

Bargraph Flashers: Any of the following status conditions can be selected to flash the P/S bargraphs. Pushing the UP ARROW button moves through the list.

When a status occurs that causes flashing P/S bargraphs, the status window will open automatically. When the flashing is acknowledged and there are no more flashing statuses the status window will return to normal and display any Engineering Units.

TABLE FB15-1 Status Conditions

Status Condition	Designator
(not used)	00 “NONE”
Alarm #1	A1
Alarm #2	A2
Alarm #3	A3
Alarm #4	A4
High Limit #1	H1
Low Limit #1	L1
Override	OR
Standby Sync #1	S1
Emerg Manual #1	M1
User Status 1	U1*
User Status 2	U2*
Error	E
High Limit #2	H2
Low Limit #2	L2
Totalizer Preset 1	P1
Totalizer Preset 2	P2
Alarm #5	A5
Alarm #6	A6
Alarm #7	A7
Alarm #8	A8
Standby Sync #2	S2
Emerg Manual #2	M2

* When U1 and/or U2 status conditions occur, the displayed status will be the ASCII characters configured for parameters HU1S and HU2S, respectively.

Overrange Display: When a displayed variable is beyond the configured range the value will be displayed, provided there are sufficient digits in the display. When a value is overrange the decimal point will flash indicating an overrange condition. This feature will not apply when the display is ranged for 0-1.

Inputs

P - Process Variable, can be displayed in engineering units or % of range.

S - Setpoint is displayed in the same units as P.

V/O - Valve/Output is displayed as %.

X - Variable X, can be displayed in engineering units or % of range.

Y - Variable Y, can be displayed in engineering units or % of range.

1 - Will cause User Status 1 to be displayed in the status window when this input goes high (>=80%).

2 - Will cause User Status 2 to be displayed in the status window when this input goes high (>=80%).

A - When this input goes high (>=80%), it will cause any flashing P/S bargraphs and status mnemonic to stop.

L - Loop Select: When this input goes high (>=80%), Range 2 will be used to scale the Process (INP) if the parameter 'HPDR' is set to 'L' (LOOP) and also scale the Setpoint if the parameter 'HSDR' is set to 'L'. The horizontal bar (Valve/Output) will be displayed as defined by the parameters 'HS1'/'HS2' and 'HD1'/HD2'. If only one valve signal is to be displayed, but 'INL' is being used, be sure that both sets of parameters are configured identically. When the input drops below 75% or is not configured, Range 1 will be used to scale the respective inputs.

Outputs

ERROR (06) - This output will go high (100%) whenever an error status is displayed in the status window.

Pulse-On (19) - This output will go high (100%) for 0.6 sec. whenever a flashing P/S bargraph is initiated.

Pulse-Off (26) - This output will go high (100%) for 0.6 sec. whenever a flashing P/S bargraph is turned off (i.e. acknowledged).

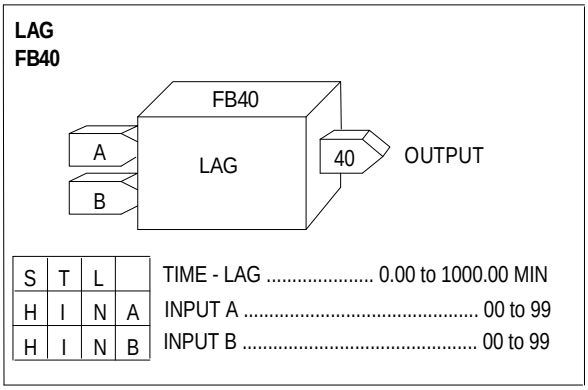
8.17 DYNAMIC COMPENSATION

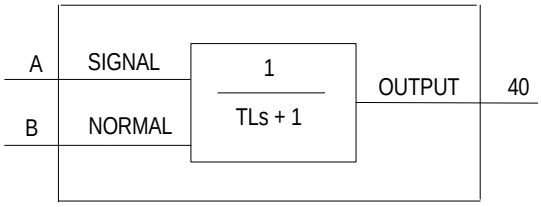
8.17.1 LAG FB40

This function block provides Lag action with a time constant 'TL' that can be set during soft configuration.

When INB is high (>=80%) or not configured, the function block will be in NORMAL operation. When it is low (<75%) the lag function will be bypassed and the output is set equal to INA.

FB Number	Output Identification
40	Output: 40





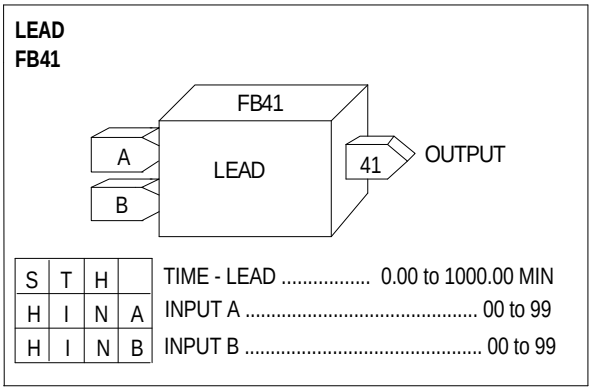
BLOCK DIAGRAM

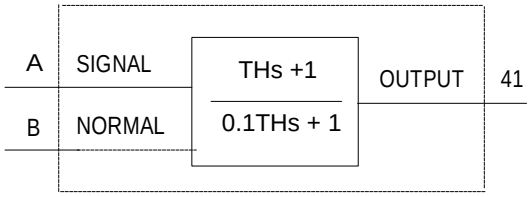
8.17.2 LEAD FB41

This function block provides Lead action with a time constant TH that can be set during soft configuration.

When INB is high (>=80%) or not configured, the function block will be in NORMAL operation. When it is low (<75%) the lead function will be bypassed and the output is set equal to INA.

FB Number	Output Identification
41	Output: 41





BLOCK DIAGRAM

8.17.3 RATE LIMITER FB42

The Rate Limiter will limit the rate at which the block output changes. Both the full scale time to ramp up 'TRU' and ramp down 'TRD' can be set independently during configuration.

When Input B goes high (>=80%), the Rate Limiter will be in NORMAL operation, and when low (<75%), the rate limit function will be bypassed which sets the output equal to Input A. If Input A is not configured, the output will be set to 0%. If Input B is not configured it will be set to 100% placing the block in the NORMAL mode.

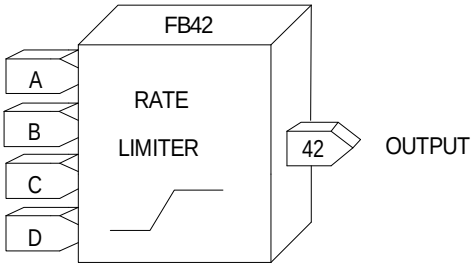
Input C, adaptive rate input, will vary the actual time set in configuration between 0% and 100% as the input signal varies from 0% to 100%.

The Rate Limiter can be used to limit the rate of change of the valve signal or the rate at which the local setpoint can be changed.

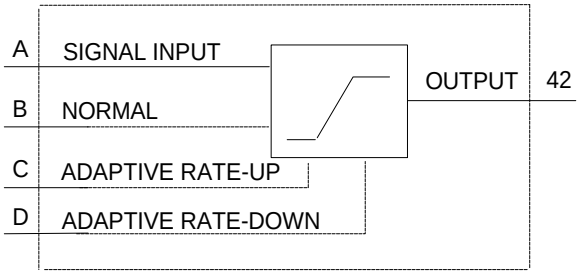
Unused Inputs
Input A: 0%
Input B: 100%
Input C: 100%
Input D: 100%

FB Number	Output Identification
42	Output: 42

RATE LIMITER
FB 42



S	T	R	U	TIME- RATE UP ..... 0.00 to 9999.99 MIN
S	T	R	D	TIME- RATE DOWN ..... 0.00 to 9999.99 MIN
H	I	N	A	INPUT A ..... 00 to 99
H	I	N	B	INPUT B (NORMAL/BYPASS) ..... 00 to 99
H	I	N	C	INPUT C (ADAPTIVE RATE-UP) ..... 00 to 99
H	I	N	D	INPUT D (ADAPTIVE RATE-DN) ..... 00 to 99



BLOCK DIAGRAM

8.17.4 DEAD TIME TABLE FB43

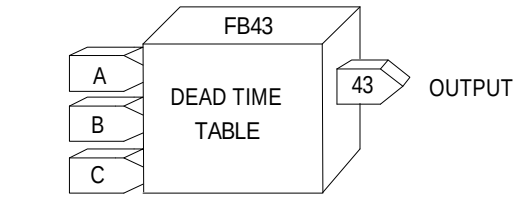
The Dead Time Table includes 50 shift registers. The Input INA will be held for a period of time and then each register value will be transferred to the next register. The maximum delay time 'TM' can be set in soft configuration. The time for each shift to occur is therefore equal to 0.02 x TM.

When INB is high (>=80%) or not configured the function block will be in NORMAL operation. When low (<75%) the dead time function is bypassed which means that all registers and the output will be set equal to INA.

Input C 'INC' is the adaptive dead time input. When used it causes the output to pick the signal from the register closest to the level of INC (e.g. Input C = 53% Output = Register 27, Input C = 56% Output = Register 28, ..).

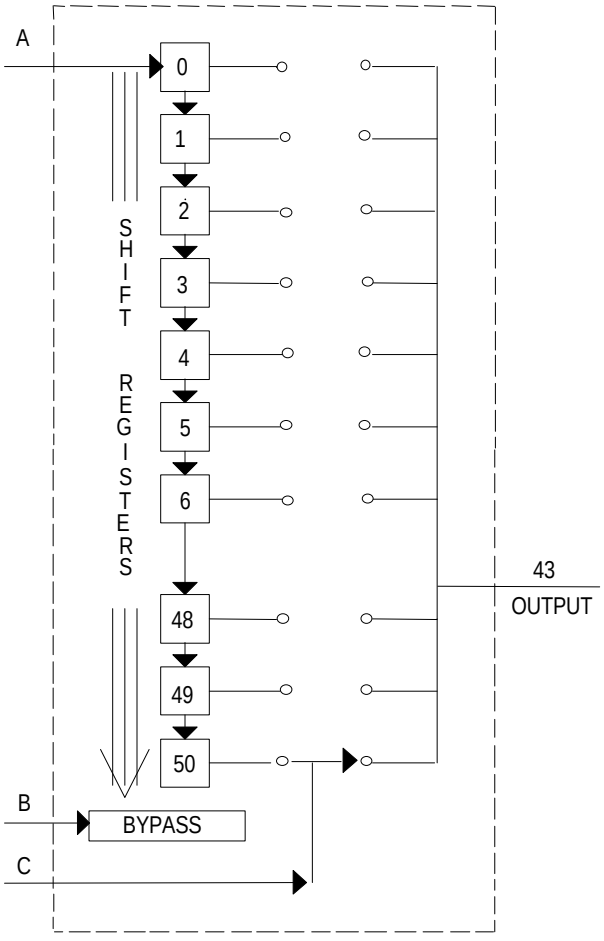
FB Number	Output Identification
43	Output: 43

DEAD TIME TABLE
FB43



S	T	M	
H	I	N	A
H	I	N	B
H	I	N	C

TIME - MAX. DELAY ..... 0 to 10000 MIN
INPUT A ..... 00 to 99
INPUT B ..... 00 to 99
INPUT C ..... 00 to 99



BLOCK DIAGRAM

8.18 MATH

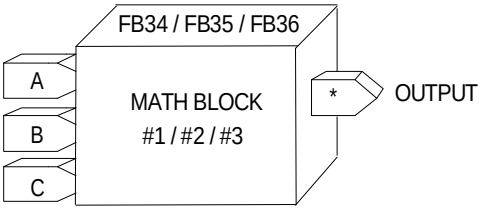
8.18.1 MATH #1/#2/#3 FB34/FB35/FB36

This function block provides general purpose mathematical capabilities required in many control applications (e.g. pressure/temperature compensation, ratio computing, signal averaging, ...). All 0-100% block inputs have a real range of 0-1, with the resultant 0-1 computed range representing a 0-100% block output. The output of the math block is not limited which allows interconnection of math blocks for more complex equations without any loss of accuracy.

Unused Inputs
Input A: 0% (0.0)
Input B: 0% (0.0)
Input C: 0% (0.0)

FB Number	Output Identification
34	Output: 34
35	Output: 35
36	Output: 36

MATH BLOCK #1 / #2 / #3
FB34 / FB35 / FB36



S	G	O	**	GAIN-OUTPUT ..... +/- .000000 to 999999
S	G	A	**	GAIN-A INPUT ..... +/- .000000 to 999999
S	G	B	**	GAIN-B INPUT ..... +/- .000000 to 999999
S	G	C	**	GAIN-C INPUT ..... +/- .000000 to 999999
S	B	O	**	BIAS-OUTPUT ..... +/- .000000 to 999999
S	B	A	**	BIAS-A INPUT ..... +/- .000000 to 999999
S	B	B	**	BIAS-B INPUT..... +/- .000000 to 999999
S	B	C	**	BIAS-C INPUT ..... +/- .000000 to 999999
H	O	**	A	OPERATION A ..... SUB/ADD/MUL/DIV
H	O	**	B	OPERATION B ..... SUB/ADD/MUL/DIV
H	I	N	A	INPUT A ..... 00 to 99
H	I	N	B	INPUT B ..... 00 to 99
H	I	N	C	INPUT C ..... 00 to 99

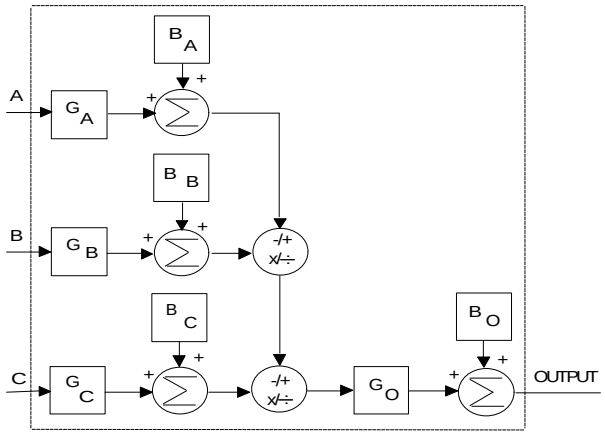
* See Output Identification
** FB34: 1, FB35: 2, FB36: 3

Signal Equation

$$S_O = G_O \{[(G_A * S_A + B_A) \underset{(-/+/*/,)}{\text{OPERATION A}} (G_B * S_B + B_B)] \underset{(-/+/*/,)}{\text{OPERATION B}} [G_C * S_C + B_C]\} + BO$$

S_A, S_B, and S_C are input A, B, and C.
S_O is the signal output.

If all three inputs are not used:
When used to multiply or divide A and B set $B_C = 1.00$
When used to multiply or divide A and B set $B_B = 1.00$



BLOCK DIAGRAM

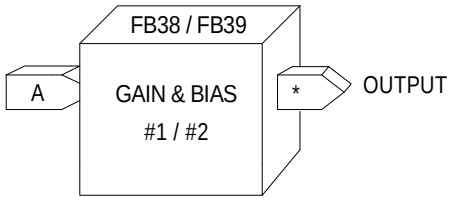
8.18.2 GAIN & BIAS #1/#2 FB38/FB39

The Gain & Bias function block provides general purpose scaling capabilities required in many control applications (e.g. valve split ranging, signal scaling, ...). All 0-100% block inputs have a real range of 0-1, with the resultant 0-1 computed range representing a 0-100% block output. The output of the Gain & Bias block is not limited allowing interconnection with other math blocks for more complex equations without loss of accuracy.

Unused Inputs
Input A: 0% (0.0)

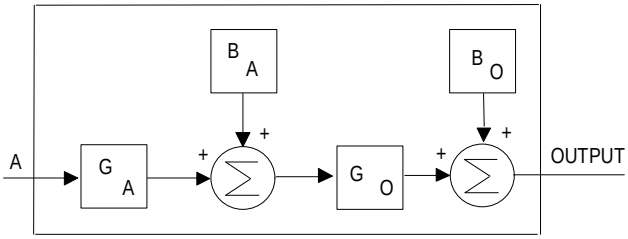
FB Number	Output Identification
38	Output: 38
39	Output: 39

GAIN & BIAS #1 / #2
FB38 / FB39



S	G	O	*	GAIN-OUTPUT ..... +/- .000000 to 999999
S	G	A	*	GAIN-A INPUT ..... +/- .000000 to 999999
S	B	O	*	BIAS-OUTPUT ..... +/- .000000 to 999999
S	B	A	*	BIAS-A INPUT ..... +/- .000000 to 999999
H	I	N	A	INPUT A ..... 00 to 99

* See Output Identification
** FB38: 5, FB39: 6



BLOCK DIAGRAM

8.18.3 DEVIATION AMPLIFIER FB22

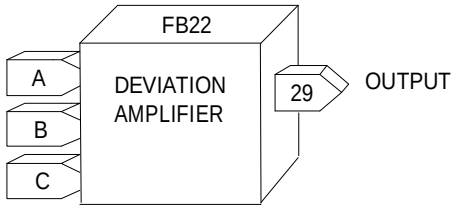
This function block computes the difference between two inputs A & B and multiplies it by a configurable Gain value. The result is summed with a third input C and a configurable Bias value.

All 0-100% block inputs have a real range of 0-1, with the resultant 0-1 computed range representing a 0-100% block output. The output of the Deviation Amplifier block is not limited.

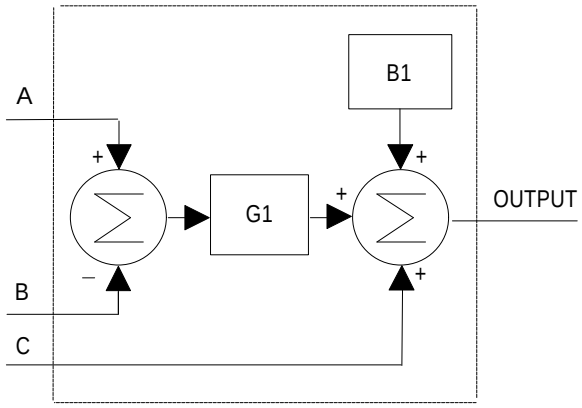
Unused Inputs (defaults)
Input A = 100% (1.0)
Input B = 0% (0.0)
Input C = 0% (0.0)

FB Number	Output Identification
22	Signal Output: 29

DEVIATION AMPLIFIER
FB22



S	G	1		GAIN ..... +/- .000001 to 999999
S	B	1		BIAS ..... +/- .000001 to 999999
H	I	N	A	INPUT A ..... 00 to 99
H	I	N	B	INPUT B ..... 00 to 99
H	I	N	C	INPUT C ..... 00 to 99



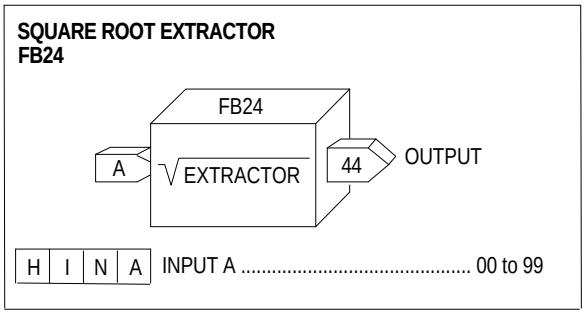
BLOCK DIAGRAM

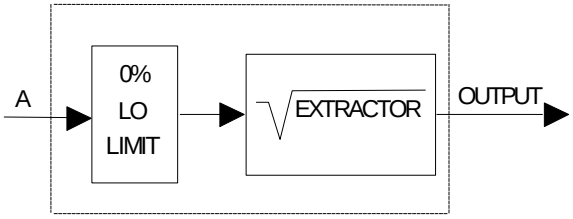
8.18.4 SQUARE ROOT EXTRACTOR FB24

This function block will extract the square root of any block input signal greater than zero. A normalized 0-100% signal will result in a normalized 0-100% block output.

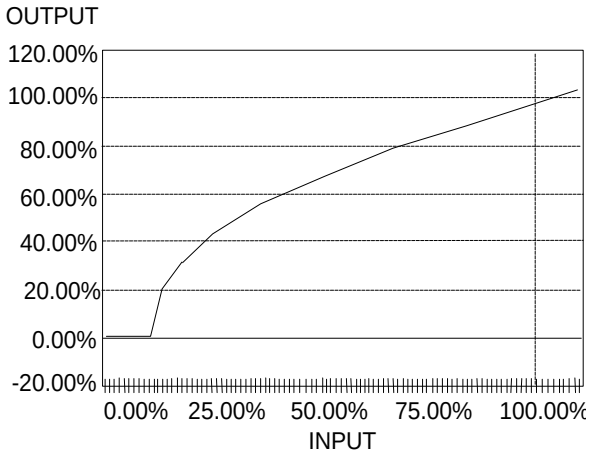
Graph 1 illustrates the function of this block over the full 0-100% input and output range. Graph 2 illustrates the block function over the first 2% of the input range. It has a built-in low limit to insure a 'fixed zero' at no flow conditions and a linearized function up to 1% of input to minimize the high gain associated with the square root function near zero.

FB Number	Output Identification
24	Linear Signal Output: 44

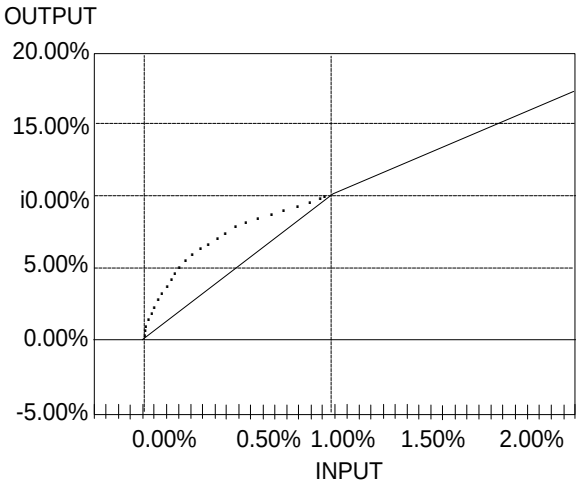




BLOCK DIAGRAM



GRAPH 1 Full Range Function



GRAPH 2 Function @ Low End

8.18.5 INTEGRATOR/TOTALIZER FB16

This function block integrates input signal **A** and increments the count accordingly. The Integrator is configured by setting the Full Scale rate, the Time Base, and Count Multiplier.

As an example, a 0-100% input represents a flow rate of 0-400 gal/min. Select SFS = 400, STB = MIN, SCM = 1, HCU = GAL. If, in this example, the input equals 50% (200 gal/min) for 1 hour the count would read 12000. In cases where the signal will be integrated over a long period of time the count may overflow the 6 digit counter. In this case a Count Multiplier greater than 1 should be used. If the Count Multiplier were set to 1000 the actual count in this example would equal 12 (indicating 12 x 1000 = GAL). In other cases it may be desirable to use a Count Multiplier less than 1 to increase resolution for small batches. If a Count Multiplier of 0.1 were used, the Count in the example would equal 120000 (indicating 120000 x 0.1 GAL).

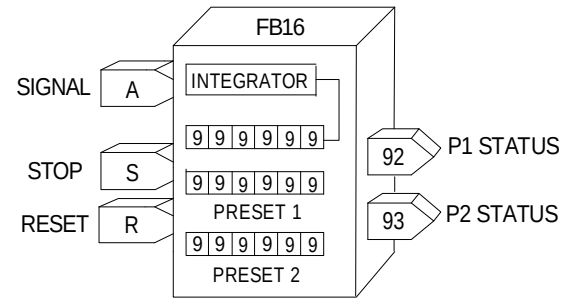
The function block also has two presets. The block outputs for these presets will go to 100% when the Count equals or exceeds the preset value. For INC action, Count >= Preset. For DEC action, Count <= Preset.

The COUNT will stop at 999999. To configure a counter that rolls over, one of the presets can be set to 999999 and the preset status connected to Input R.

Input S (STOP) will cause the integrator to stop incrementing the COUNT when it goes high (>=80%). Any accumulated value in the integrator will be retained while in the STOP mode.

Input R (RESET) will cause the COUNT and any accumulated value in the integrator to be reset to 0. The reset action will occur when Input R goes high (>=80%) and will be executed first in the block cycle so that any Input A will also be integrated during the same cycle.

INTEGRATOR/TOTALIZER
FB16



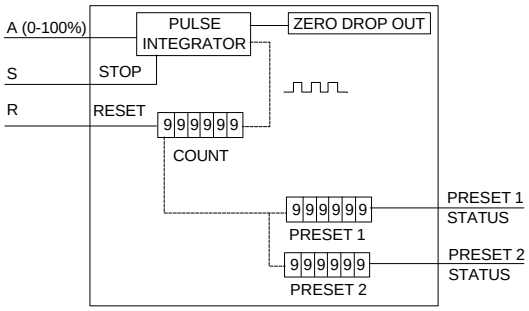
S	F	S		FULL SCALE VALUE ..... 0.00001 to 999999
S	T	B		TIME BASE ..... SEC/MIN/HR/DAY/WK
S	C	M		COUNT MULTIPLIER ..... 0.00001 to 999999
S	Z	D	O	ZERO DROP OUT ..... 0.0% to 30.0%
S	S	V		STARTING VALUE ..... 0 to 999999
S	P	1		PRESET 1 ..... 0 to 999999
S	P	2		PRESET 2 ..... 0 to 999999
S	D	I	R	DIRECTION ..... INC/DEC
H	C	U		COUNT UNITS ..... (****)
H	T	D	D	TOTALIZER DISPLA'Y DISABLE ..... NO/YES
H	P	C	D	PRESET CHANGE DISABLE ..... NO/YES
H	I	N	A	INPUT A (SIGNAL) ..... 00 to 99
H	I	N	S	INPUT S (STOP) ..... 00 to 99
H	I	N	R	INPUT R (RESET) ..... 00 to 99

All Integrator/Totalizer displays (C, M, 1, & 2) will be available for display using the D pushbutton, unless the parameter **HTDD** is set to YES. Also the values of the Presets can be changed when they are displayed unless the parameter **HPCD** 'Presets Change Disabled' is set to YES.

The counter will hold the count when the station has a power outage. When starting a new batch, the counter should be reset using INR.

(continued on next page)

FB Number	Output Identifications
16	P1 Status: 92 P2 Status: 93



BLOCK DIAGRAM

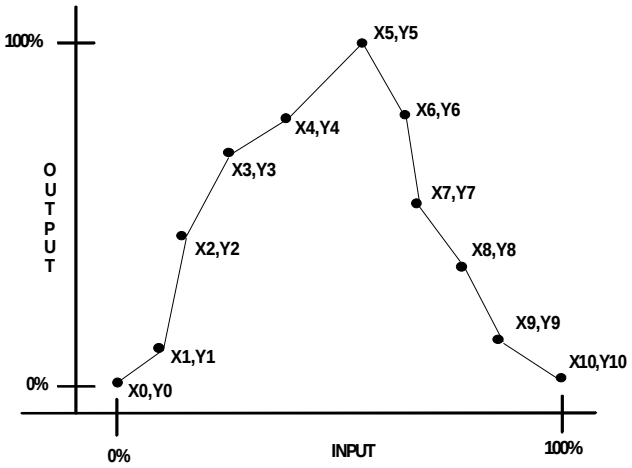
8.18.6 10 SEGMENT CHARACTERIZER #1/#2 FB44/FB72

The 10-Segment Characterizer provides X,Y co-ordinate selections that can be used to obtain various input/output characterizations.

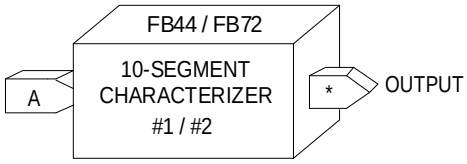
Input A is the X variable, and the Output is Y.

This function block can be used for linearizing signals in many process applications, including pH, compressor surge, ... All 10 segments must have valid configuration values. Each X_n must be greater or equal to X_{n-1}. Inputs that are less than X_0 or greater than X_{10} will have outputs equal to Y_0 or Y_{10}.

FB Number	Output Identification
44	Characterized Signal: 45
72	Characterized Signal: 57



10-SEGMENT CHARACTERIZER #1 / #2
FB44 / FB72



S	X	0		INPUT CO-ORDINATE X0 ..... 0.00 to 100.00%
S	X	1		INPUT CO-ORDINATE X1 ..... 0.00 to 100.00%
S	X	2		INPUT CO-ORDINATE X2 ..... 0.00 to 100.00%
S	X	3		INPUT CO-ORDINATE X3 ..... 0.00 to 100.00%
S	X	4		INPUT CO-ORDINATE X4 ..... 0.00 to 100.00%
S	X	5		INPUT CO-ORDINATE X5 ..... 0.00 to 100.00%
S	X	6		INPUT CO-ORDINATE X6 ..... 0.00 to 100.00%
S	X	7		INPUT CO-ORDINATE X7 ..... 0.00 to 100.00%
S	X	8		INPUT CO-ORDINATE X8 ..... 0.00 to 100.00%
S	X	9		INPUT CO-ORDINATE X9 ..... 0.00 to 100.00%
S	X	1	0	INPUT CO-ORDINATE X10 ..... 0.00 to 100.00%
S	Y	0		OUTPUT CO-ORDINATE Y0 .. 0.00 to 100.00%
S	Y	1		OUTPUT CO-ORDINATE Y1 .. 0.00 to 100.00%
S	Y	2		OUTPUT CO-ORDINATE Y2 .. 0.00 to 100.00%
S	Y	3		OUTPUT CO-ORDINATE Y3 .. 0.00 to 100.00%
S	Y	4		OUTPUT CO-ORDINATE Y4 .. 0.00 to 100.00%
S	Y	5		OUTPUT CO-ORDINATE Y5 .. 0.00 to 100.00%
S	Y	6		OUTPUT CO-ORDINATE Y6 .. 0.00 to 100.00%
S	Y	7		OUTPUT CO-ORDINATE Y7 .. 0.00 to 100.00%
S	Y	8		OUTPUT CO-ORDINATE Y8 .. 0.00 to 100.00%
S	Y	9		OUTPUT CO-ORDINATE Y9 .. 0.00 to 100.00%
S	Y	1	0	OUTPUT CO-ORDINATE Y10 . 0.00 to 100.00%
H	I	N	A	INPUT A ..... 00 to 99

* See Output Identifications

8.19 MISCELLANEOUS

8.19.1 BATCH SWITCH FB53

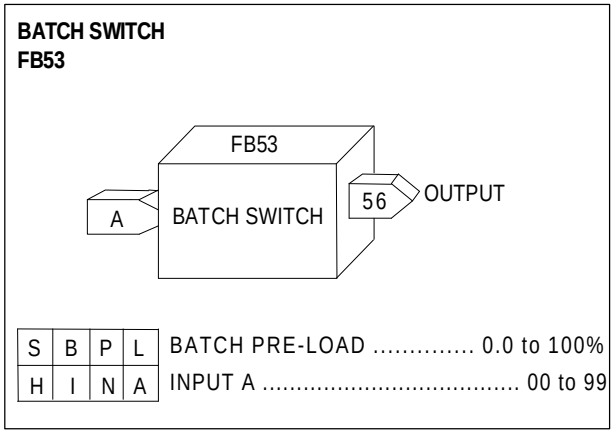
The Batch Switch is normally used in the feedback path of a controller to reduce the amount of overshoot in a batch startup situation. When the signal input INA is within the 0-100% range the signal will be passed normally to the controller feedback and cause normal reset action.

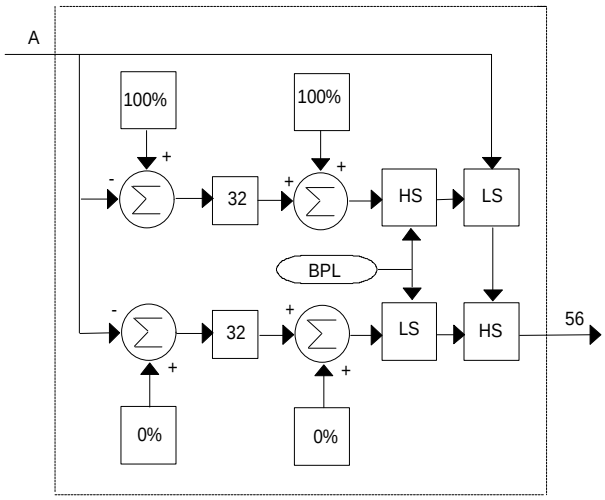
If INA (normally the controller output) equals or exceeds a limit, the feedback signal to the controller will be modified to keep the controller output at the limit setting (e.g. if INA exceeds 100% the feedback signal will be reduced).

In some cases, as with a large gain error, the feedback can be reduced too much. This will eliminate any overshoot, but may have the opposite effect of a very sluggish startup. To overcome this, the Batch Switch has a preload parameter 'SBPL' that can be set in soft configuration. The setting puts a limit on the amount of change that can be made to the feedback signal.

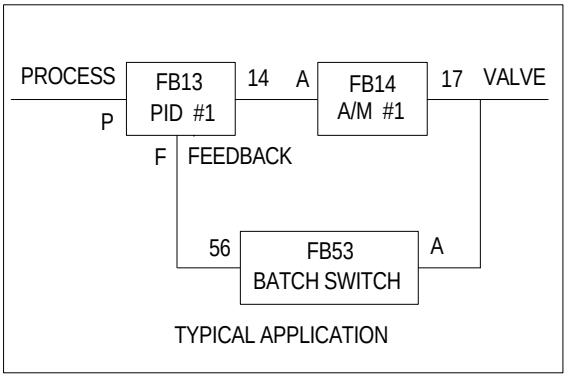
Typical Application
When the valve signal is <0% or >100% FB53 adjusts the controller feedback signal to keep the controller output at the limit setting (i.e. 0% or 100%). However, FB53 will not adjust not adjust the feedback signal above the PreLoad when the 0% limit is reached or below the PreLoad when the 100% limit is reached.

FB Number	Output Identification
53	Switch Output: 56





BLOCK DIAGRAM



TYPICAL APPLICATION

8.19.2 PASSWORD SECURITY FB75

This function block works in combination with the dip switch located on the MPU board to provide various levels of configuration security. The dip switch has the following lockout positions:

SW1 .. S (soft configuration)
SW2 .. ALARM (quick alarm)
SW3 .. TUNE (quick tune)
SW4 .. H/F/T (configuration)
SW5 .. C (calibration)

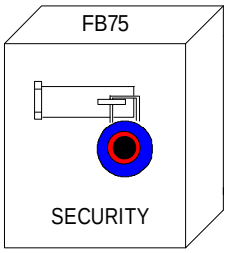
When the lockout switch is on, that portion of configuration can be viewed but not changed. One exception is FB75 which can only viewed/changed when SW4 is off.

The purpose of the Password Security function block is to permit changing configuration parameters when the lockout switches are on. Configuration parameters can always be viewed by stepping down past the password entry prompt.

When a configuration parameter is locked out, and password security is active, a special prompt (four underscore characters with the left one blinking) will appear in the 4 character display. The UP/DOWN arrows are used to select a character and the ---> pushbutton to move to the next position. Once all characters are in place the STORE button is pressed. If the correct password has been entered configuration changes can then be entered. Unless EXIT is pressed, any number of changes can be made without re-entering the password. When an incorrect password has been entered the special prompt will again appear. The EXIT pushbutton can be pressed to return to normal operation.

Password security is active, if FB75 has an ESN 'Execution Sequence Number' and a password has been configured.

PASSWORD SECURITY
FB75



H	T	P	W	'TUNE' PASSWORD ..... ****
H	A	P	W	'ALARM' PASSWORD ..... ****
H	S	P	W	'S CONFIGURATION' PASSWORD ..... ****
H	H	P	W	'H CONFIGURATION' PASSWORD ..... ****
H	C	P	W	'CALIBRATION' PASSWORD ..... ****

8.19.3 HART® INTERFACE FB98

This function block groups parameters associated with HART communication functions. It should be used whenever higher level devices are intended to interface with the Model 348.

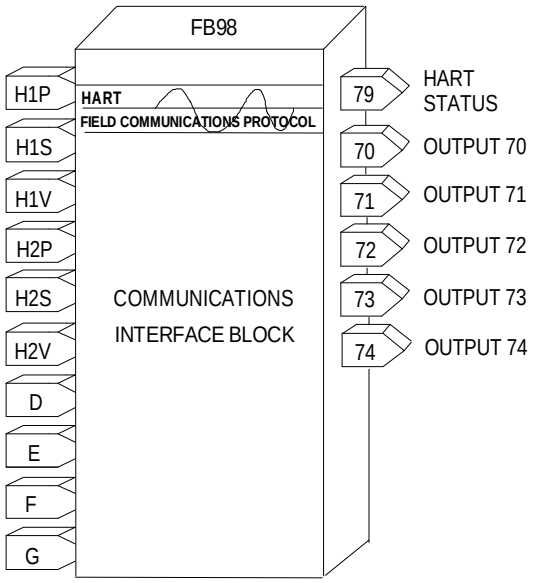
Parameters 'H1P', 'H1S', & 'H1V' allow specific block outputs to be configured as the LOOP 1 variables. In most cases these will be the same as the loop variable inputs to the Operator Display block. Parameters 'H2P', H2S', & 'H2V' are the LOOP 2 variables.

The polling address can be configured from 1 to 15, whenever the Model 348's are used in a multi-drop configuration. Otherwise the address should be set to 0.

Other Moore Products Co. controller products (i.e. MYCRO, 352, ...) have a C/L function which allows the Console operator and the Local operator to arbitrate control of the loop functions. If it is desired to utilize this function with the Model 348, parameter HP1F should be set to CL. In this case PB1 (upper position C, lower position L) is used to switch the Model 348 between Console and Local from the faceplate. When in Local, changes can only be made from the Model 348 faceplate, except for a 'Go To Console' command. If the Model 348 is in Console, changes will only be accepted over the HART fieldbus except for local operation of PB1, the D & ACK pushbuttons. Also, in order for the C/L PB1 function to operate, FB98 must have a valid ESN, PB1 must have a valid ESN, and parameter HP1F must equal CL. In the case where the C/L function is not used, the status that gets reported to the higher level device will always reflect Console so that the higher level device will be aware that changes can be made. The one exception, is when the Model 348 goes into configuration, then the status will be reported as Local and HOLD. When the CL function is not used changes can be made locally or over the HART fieldbus.

(continued on next page)

HART INTERFACE
FB98



H	H	1	P	HART - LOOP 1 PROCESS ..... 00 to 99
H	H	1	S	HART - LOOP 1 SETPOINT ..... 00 to 99
H	H	1	V	HART - LOOP 1 VALVE ..... 00 to 99
H	H	2	P	HART - LOOP 2 PROCESS ..... 00 to 99
H	H	2	S	HART - LOOP 2 SETPOINT ..... 00 to 99
H	H	2	V	HART - LOOP 2 VALVE ..... 00 to 99
H	P	O	L	POLLING ADDRESS ..... 0 to 15
H	P	1	F	PB1 FUNCTION USER/L1EI/L2EI/CL
H	P	2	F	PB2 FUNCTION USER/L1EI/L2EI
H	I	N	D	INPUT D ..... 00 to 99
H	I	N	E	INPUT E ..... 00 to 99
H	I	N	F	INPUT F ..... 00 to 99
H	I	N	G	INPUT G ..... 00 to 99
H	H	T	N	HART TAG NAME ..... 8 CHAR (ASCII)
H	D	E	S	HART DESCRIPTOR ..... 16 CHAR (ASCII)
H	M	S	G	HART MESSAGE ..... 32 CHAR (ASCII)
H	D	A	T	HART DATE .....DD/MM/YY
H	D	S	N	HART DEVICE SER. # ..... 0 to 999999
H	V	C	1	HART VARIABLE CODE 1 ..... 0 to 8
H	V	C	2	HART VARIABLE CODE 2 ..... 0 to 8
H	V	C	3	HART VARIABLE CODE 3 ..... 0 to 8
H	V	C	4	HART VARIABLE CODE 4 ..... 0 to 8
H	R	P		HART RESP. PREAMBLES ..... 5 to 50

If it is desired to use External/Internal Setpoint (e.g. FCO13) and have control of the E/I switching from a higher level device, then either PB1 or PB2 should be tied to the individual loop commands that control the E/I switching. In this case parameters HP1F or HP2F should be configured for Loop1 E/I 'L1EI' or Loop 2 E/I 'L2EI'. In the case where the E/I function is not selected for a loop, the Loop Status reported to the Link will be I.

If a pushbutton is not intended for operation from a higher level device then parameter HP_F should be set to USER.

TABLE FB98-1 Variable Code Choices

HART Variable Code Choices	348 Function Block	Description	Units
0	UNASSIGNED		
1	FB81	Direct Process Pressure	(see FB81)
2	FB82	Temperature	(see FB82)
3	FB01	Analog Input #1	%
4	FB02	Analog Input #2	%
5	FB25	Analog Input #3	%
6	FB85	Pneumatic Input #1	%
7	FB86	Pneumatic Input #2	%
8	FB87	Pneumatic Input #3	%
9	FB81	Static Pressure	%
10	FB81	Capsule Temperature	%

The Model 348 has two controller function blocks that may also require interfacing with higher level operator stations. As such, certain information and commands are grouped into LOOPS (i.e. Loop 1 or Loop 2). For example, A/M HART commands for Loop 1 are always associated with FB14, while Loop 2 with FB55; E/I HART commands can be associated as defined above. Setpoint commands for Loop 1 are associated with FB17, while Loop 2 FB46; Alarm functions for Loop 1 are associated with FB12, while Loop 2 with FB73; ..... .
Other Function Block outputs can be connected to Inputs D-G for communication to higher level devices via HART. Also, higher level devices can send signals to the Model 348 for interconnection with other function blocks using FB98 outputs 70-74.

Parameters HVC1, HVC2, HVC3, and HVC4 do not need to be set when communicating with Moore Products Co. master devices, such as the APACS

(continued on next page)

HFM, Model 325 URICA, and Model 385 Loop Operator's Station.

The HART communication protocol includes standard commands that can request variables as primary, secondary, tertiary, or fourth. Parameters HVC_ can be used to assign them to variables within the Model 348. See Table FB98-1 for a complete listing. Certain variables can only be assigned when the options are installed.

■

9.0 FACTORY CONFIGURED OPTIONS

These are configurations stored in permanent memory (ROM) that can be transferred to the configuration memory (battery backed RAM) with just a few keystrokes. A complete listing off all the factory configured options is given below. The complete documentation for all **FCOs** is listed on the following pages.

9.1 FCO 00 ..... ESN Reset (ESN=00)
9.2 FCO 01 ..... Single-Loop PID Controller (TSP)*
9.3 FCO 02 ..... Single-Loop PID Controller (NTSP)**
9.4 FCO 03 ..... External-Set PID Controller (TSP)
9.5 FCO 04 ..... External-Set PID Controller (NTSP)
9.6 FCO 05 ..... Ratio-Set PID Controller
9.7 FCO 10 ..... Default Configuration
9.8 FCO 11 ..... Single-Loop PID Controller (TSP) - C/L Operation
9.9 FCO 12 ..... Single-Loop PID Controller (NTSP) - C/L Operation
9.10 FCO 13 ..... External-Set PID Controller (TSP) - C/L Operation
9.11 FCO 14 ..... External-Set PID Controller (NTSP) - C/L Operation
9.12 FCO 15 ..... Ratio-Set PID Controller - C/L Operation
9.13 FCO 20 ..... Single Station Cascade Controller(TSP)
9.14 FCO 25 ..... Dual-Loop PID Controllers (TSP)
9.15 FCO 26 ..... Dual-Loop PID Controllers (NTSP)
9.16 FCO 31 ..... Single-Loop PID Controller (TSP) – Pressure Input

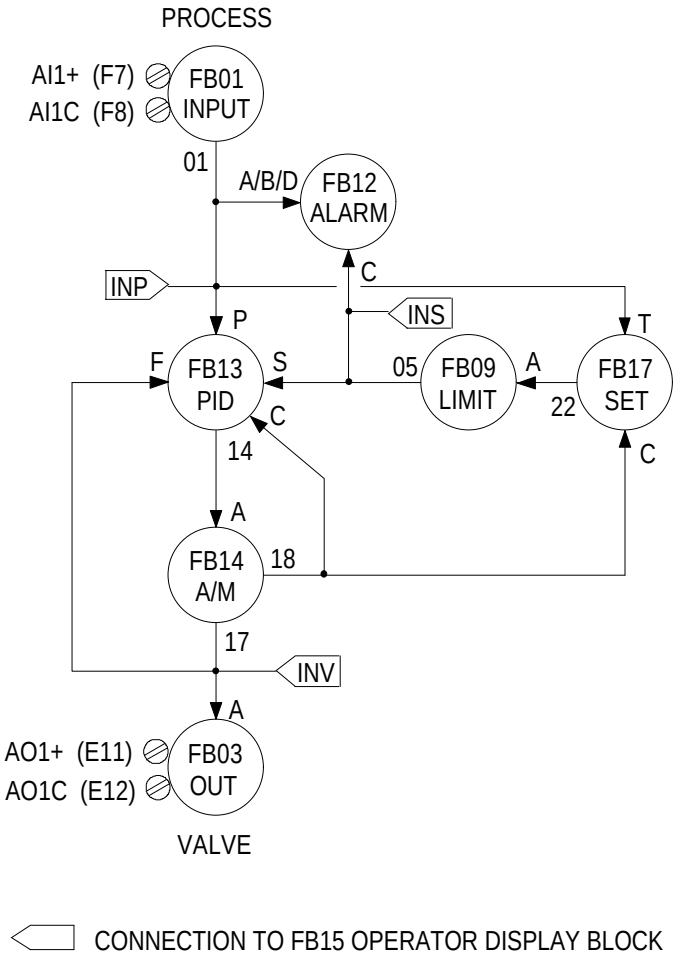
* TSP = Tracking Setpoint
** NTSP = Not-Tracking Setpoint

9.1 FCO 00 ESN RESET (ESN=00)

Sets all ESNs to 00 except FB15 which is set to 40

9.2 FCO 01 Single-Loop PID Controller (TSP)

With: Hi/Lo Process Alarms
Deviation Alarm
Tracking Setpoint
Setpoint Limits
4-20 mA Input/Output



CONFIGURATION PARAMETERS

	T	H	S	C
FB01	ESN 05	SRE NO	DV1 0.00 SEC	
FB03	ESN 45	INA 17 INB 00		
FB09	ESN 14	DSD NO INA 22	LL1 0.00% HL1 100.00%	
FB12	ESN 15	Q1R 4 (%) Q2R 4 (%) Q3R 4 (%) Q4R 4 (%) A1T HI A2T LO A3T DEV A4T NONE INA 01 INB 01 INC 05 IND 01 A1I 0.0 SEC A2I 0.0 SEC A3I 0.0 SEC A4I 0.0 SEC A1O 0.0 SEC A2O 0.0 SEC A3O 0.0 SEC A4O 0.0 SEC A1R NO A2R NO A3R NO A4R NO	SA1 100.00% SA2 0.00% SA3 100.00% SA4 0.00% DA1 0.5% DA2 0.5% DA3 0.5% DA4 0.5% EA1 EN EA2 EN EA3 EN EA4 DIS	
FB13	ESN 30	C1T PID MRT NO INP 01 INS 05 INF 17 INA 00 INC 18	A1 REV PG1 1.00 TI1 100.00 M/R TD1 0.00 MIN DG1 10.00 MR1 0.0% HL1 100.00% LL1 0.00%	

(continued on next page)

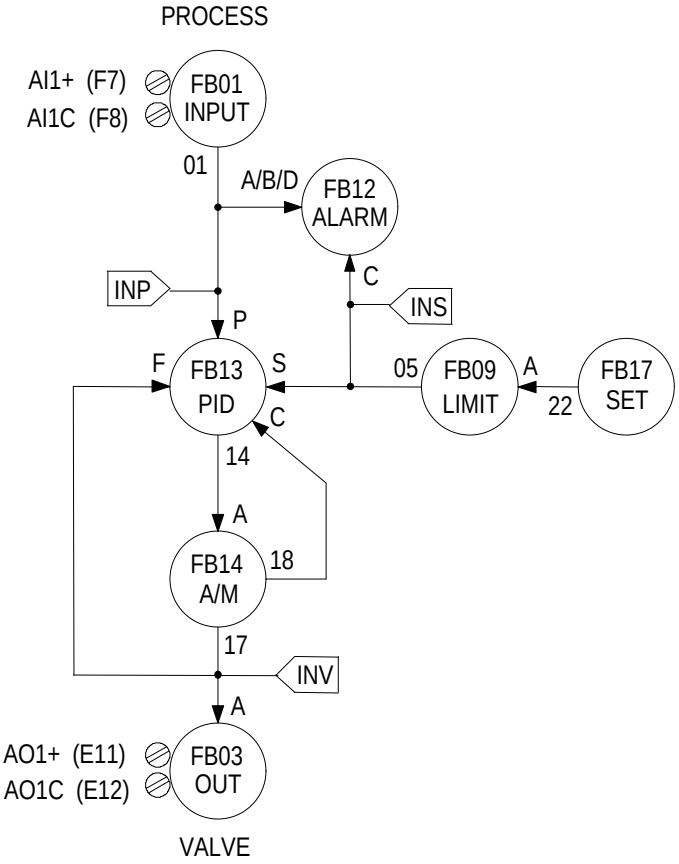
	T	H	S	C
FB14	ESN 35	AO NO	PUM 0.00%	
		PU LP		
		PUL NO		
		INA 14		
		INT 00		
		INE 00		
		INS 00		
		INL 00		
FB15	ESN 40	INP 01	DP1 0.00	
		INS 05	PL1 0.00000	
		INV 17	PH1 100.000	
		INX 00	DP2 0.00	
		INY 00	PL2 0.00000	
		INA 00	PH2 100.000	
		INL 00	DPX 0.00	
		PDR L	XL 0.00000	
		SDR L	XH 100.000	
		HS1 VALVE	DPY 0.00	
		HS2 VALVE	YL 0.0000	
		HD1 YES	YH 100.000	
		HD2 YES	TST 10 SEC	
		SCF YES	TSI TN1	
		IN1 00		
		IN2 00		
		U1S U1		
		U2S U2		
		TN1 TAG NAME 1		
		TN2 TAG NAME 2		
		EU1 PRCT		
		EU2 PRCT		
		EUX PRCT		
		EUY PRCT		
		FL1 A1		
		FL2 A2		
		FL3 A3		
		FL4 NONE		
		FL5 NONE		
FB17	ESN 10	INT 01		
		INC 18		
		INL 00		

(continued on next page)

T		H	S	C
FB98	ESN 90	H1P 01		
		H1S 05		
		H1V 17		
		H2P 00		
		H2S 00		
		H2V 00		
		POL 0		
		P1F USER		
		P2F USER		
		IND 00		
		INE 00		
		INF 00		
		ING 00		
		HTN HART TAG		
		DES HART DESCRIPTOR		
		MSG HART MESSAGE		
		DAT 01/01/93		
		DSN 0		
		VC1 3		
		VC2 4		
		VC3 5		
		VC4 0		
		RP 5		

9.3 FCO 02 SINGLE-LOOP PID CONTROLLER (NTSP)

With: Hi/Lo Process Alarms
Deviation Alarm
Non-Tracking Setpoint
Setpoint Limits
4-20 mA Input/Output



CONFIGURATION PARAMETERS

	T	H	S	C
FB01	ESN 05	SRE NO	DV1 0.00 SEC	
FB03	ESN 45	INA 17 INB 00		
FB09	ESN 14	DSD NO INA 22	LL1 0.00% HL1 100.00%	
FB12	ESN 15	Q1R 4 (%) Q2R 4 (%) Q3R 4 (%) Q4R 4 (%) A1T HI A2T LO A3T DEV A4T NONE INA 01 INB 01 INC 05 IND 01 A1I 0.0 SEC A2I 0.0 SEC A3I 0.0 SEC A4I 0.0 SEC A1O 0.0 SEC A2O 0.0 SEC A3O 0.0 SEC A4O 0.0 SEC A1R NO A2R NO A3R NO A4R NO	SA1 100.00% SA2 0.00% SA3 100.00% SA4 0.00% DA1 0.5% DA2 0.5% DA3 0.5% DA4 0.5% EA1 EN EA2 EN EA3 EN EA4 DIS	
FB13	ESN 30	C1T PID MRT NO INP 01 INS 05 INF 17 INA 00 INC 18	A1 REV PG1 1.00 TI1 100.00 M/R TD1 0.00 MIN DG1 10.00 MR1 0.00% HL1 100.00% LL1 0.00%	

(continued on next page)

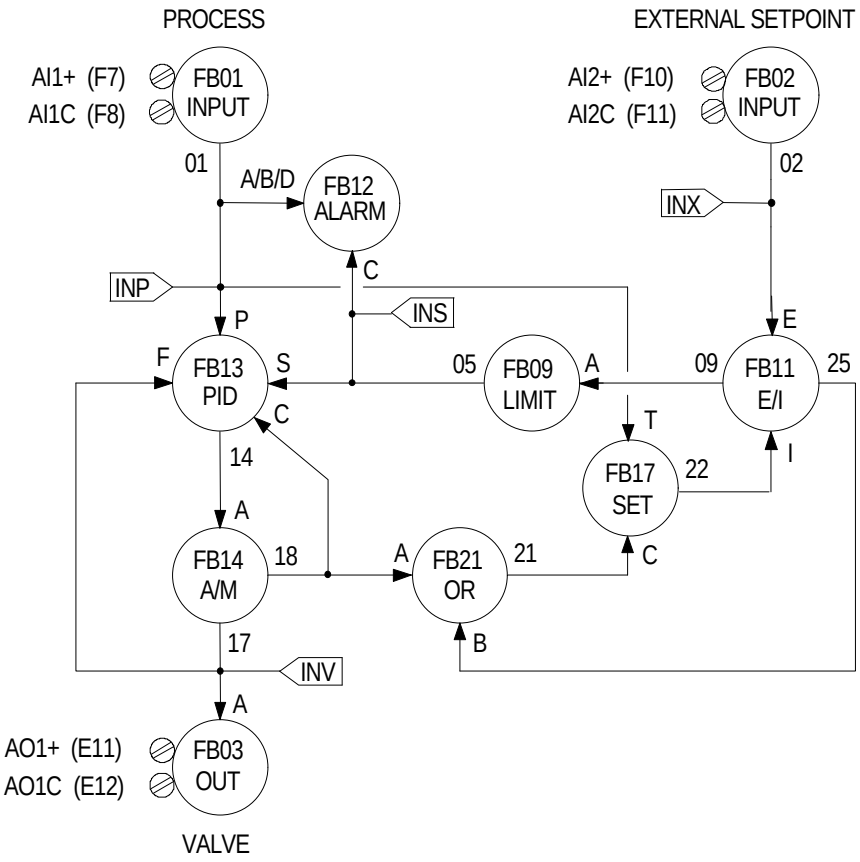
	T	H	S	C
FB14	ESN 35	AO NO	PUM 0.00%	
		PU LP		
		PUL NO		
		INA 14		
		INT 00		
		INE 00		
		INS 00		
		INL 00		
FB15	ESN 40	INP 01	DP1 0.00	
		INS 05	PL1 0.00000	
		INV 17	PH1 100.000	
		INX 00	DP2 0.00	
		INY 00	PL2 0.00000	
		INA 00	PH2 100.000	
		INL 00	DPX 0.00	
		PDR L	XL 0.00000	
		SDR L	XH 100.000	
		HS1 VALVE	DPY 0.00	
		HS2 VALVE	YL 0.00000	
		HD1 YES	YH 100.000	
		HD2 YES	TST 10 SEC	
		SCF YES	TSI TN1	
		IN1 00		
		U1S U1		
		U2S U2		
		TN1 TAG NAME 1		
		TN2 TAG NAME 2		
		EU1 PRCT		
		EU2 PRCT		
		EUX PRCT		
		EUY PRCT		
		FL1 A1		
		FL2 A2		
		FL3 A3		
		FL4 NONE		
		FL5 NONE		
FB17	ESN 10	INT 00		
		INC 00		
		INL 00		

(continued on next page)

	T	H	S	C
FB98	ESN 90	H1P 01		
		H1S 05		
		H1V 17		
		H2P 00		
		H2S 00		
		H2V 00		
		POL 00		
		P1F USER		
		P2F USER		
		IND 00		
		INE 00		
		INF 00		
		ING 00		
		HTN HART TAG		
		DES HART DESCRIPTOR		
		MSG HART MESSAGE		
		DAT 01/01/93		
		DSN 0		
		VC1 3		
		VC2 4		
		VC3 5		
		VC4 0		
		RP 5		

9.4 FCO 03 EXTERNAL-SET PID CONTROLLER (TSP)

With: HI/Lo Process Alarms
Deviation Alarm
Tracking Setpoint
Setpoint Limits
4-20 mA Inputs/Output



CONFIGURATION PARAMETERS

	T	H	S	C
FB01	ESN 05	SRE NO	DV1 0.00 SEC	
FB02	ESN 07	SRE NO	DV2 0.00 SEC	
FB03	ESN 45	INA 17 INB 00		
FB09	ESN 14	DSD NO INA 09	LL1 0.00% HL1 100.00%	
FB11	ESN 13	EO NO PU LP S1A SUS DSD NO INE 02 INI 22 INA 00		
FB12	ESN 15	Q1R 4 (%) Q2R 4 (%) Q3R 4 (%) Q4R 4 (%) A1T HI A2T LO A3T DEV A4T NONE INA 01 INB 01 INC 05 IND 01 A1I 0.0 SEC A2I 0.0 SEC A3I 0.0 SEC A4I 0.0 SEC A1O 0.0 SEC A2O 0.0 SEC A3O 0.0 SEC A4O 0.0 SEC A1R NO A2R NO A3R NO A4R NO	SA1 100.00% SA2 0.00% SA3 100.00% SA4 0.00% DA1 0.5% DA2 0.5% DA3 0.5% DA4 0.5% EA1 EN EA2 EN EA3 EN EA4 DIS	

(continued on next page)

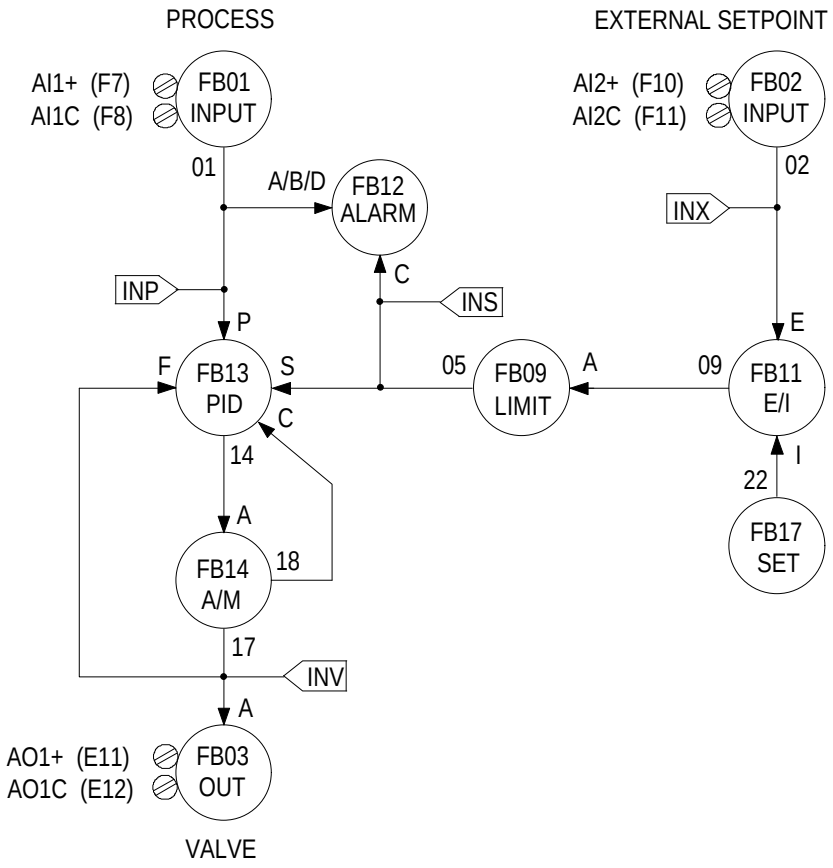
	T	H	S	C
FB13	ESN 30	C1T PID	A1 REV	
		MRT NO	PG1 1.00	
		INP 01	TI1 100.00 M/R	
		INS 05	TD1 0.00 MIN	
		INF 17	DG1 10.00	
		INA 00	MR1 0.00%	
		INC 18	HL1 100.00%	
			LL1 0.00%	
FB14	ESN 35	AO NO	PUM 0.0%	
		PU LP		
		PUL NO		
		INA 14		
		INT 00		
		INE 00		
		INS 00		
		INL 00		
FB15	ESN 40	INP 01	DP1 0.00	
		INS 05	PL1 0.00000	
		INV 17	PH1 100.000	
		INX 02	DP2 0.00	
		INY 00	PL2 0.00000	
		INA 00	PH2 100.000	
		INL 00	DPX 0.00	
		PDR L	XL 0.00000	
		SDR L	XH 100.000	
		HS1 VALVE	DPY 0.00	
		HS2 VALVE	YL 0.00000	
		HD1 YES	YH 100.000	
		HD2 YES	TST 10 SEC	
		SCF YES	TSI TN1	
		IN1 00		
		IN2 00		
		U1S U1		
		U2S U2		
		TN1 TAG NAME 1		
		TN2 TAG NAME 2		
		EU1 PRCT		
		EU2 PRCT		
		EUX PRCT		
		EUY PRCT		
		FL1 A1		
		FL2 A2		

(continued on next page)

	T	H	S	C
FB15 (cont'd)	ESN 40	FL3 A3 FL4 NONE FL5 NONE		
FB17	ESN 10	INT 01 INC 21 INL 00		
FB21	ESN 38	LT2 OR INA 18 INB 25		
FB98	ESN 90	H1P 01 H1S 05 H1V 17 H2P 00 H2S 00 H2V 00 POL 0 P1F USER P2F USER IND 00 INE 00 INF 00 ING 00 HTN HART TAG DES HART DESCRIPTOR MSG HART MESSAGE DAT 01/01/93 DSN 0 VC1 3 VC2 4 VC3 5 VC4 0 RP 5		

9.5 FCO 04 EXTERNAL-SET PID CONTROLLER (NTSP)

With: HI/Lo Process Alarms
Deviation Alarm
Non-Tracking Setpoint
Setpoint Limits
4-20 mA Inputs/Output



CONFIGURATION PARAMETERS

	T	H	S	C
FB01	ESN 05	SRE NO	DV1 0.00 SEC	
FB02	ESN 07	SRE NO	DV2 0.00 SEC	
FB03	ESN 45	INA 17 INB 00		
FB09	ESN 14	DSD NO INA 09	LL1 0.00% HL1 100.00%	
FB11	ESN 13	EO NO PU LP S1A SUS DSD NO INE 02 INI 22 INA 00		
FB12	ESN 15	Q1R 4 (%) Q2R 4 (%) Q3R 4 (%) Q4R 4 (%) A1T HI A2T LO A3T DEV A4T NONE INA 01 INB 01 INC 05 IND 01 A1I 0.0 SEC A2I 0.0 SEC A3I 0.0 SEC A4I 0.0 SEC A1O 0.0 SEC A2O 0.0 SEC A3O 0.0 SEC A4O 0.0 SEC A1R NO A2R NO A3R NO A4R NO	SA1 100.00% SA2 0.00% SA3 100.00% SA4 0.00% DA1 0.5% DA2 0.5% DA3 0.5% DA4 0.5% EA1 EN EA2 EN EA3 EN EA4 DIS	

(continued on next page)

	T	H	S	C
FB13	ESN 30	C1T PID	A1 REV	
		MRT NO	PG1 1.00	
		INP 01	TI1 100.00 M/R	
		INS 05	TD1 0.00 MIN	
		INF 17	DG1 10.00	
		INA 00	MR1 0.0%	
		INC 18	HL1 100.00%	
			LL1 0.00%	
FB14	ESN 35	AO NO	PUM 0.00%	
		PU LP		
		PUL NO		
		INA 14		
		INT 00		
		INE 00		
		INS 00		
		INL 00		
FB15	ESN 40	INP 01	DP1 0.00	
		INS 05	PL1 0.00000	
		INV 17	PH1 100.000	
		INX 02	DP2 0.00	
		INY 00	PL2 0.00000	
		INA 00	PH2 100.000	
		INL 00	DPX 0.00	
		PDR L	XL 0.00	
		SDR L	XH 100.00	
		HS1 VALVE	DPY 0.00	
		HS2 VALVE	YL 0.00	
		HD1 YES	YH 100.00	
		HD2 YES	TST 10 SEC	
		SFC YES	TSI TN1	
		IN1 00		
		IN2 00		
		U1S U1		
		U2S U2		
		TN1 TAG NAME 1		
		TN2 TAG NAME 2		
		EU1 PRCT		
		EU2 PRCT		
		EUX PRCT		
		EUY PRCT		
		FL1 A1		
		FL2 A2		

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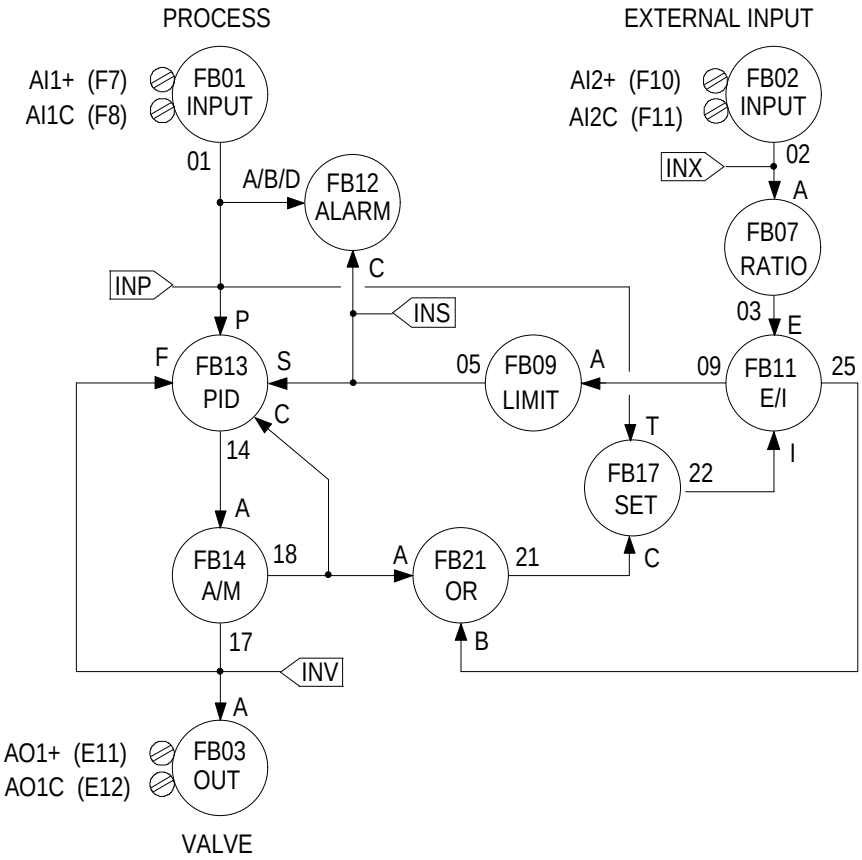
	T	H	S	C
FB15 (cont'd)	ESN 40	FL3 A3 FL4 NONE FL5 NONE		
FB17	ESN 10	INT 00 INC 00 INL 00		
FB98	ESN 90	H1P 01 H1S 05 H1V 17 H2P 00 H2S 00 H2V 00 POL 0 P1F USER P2F USER IND 00 INE 00 INF 00 ING 00 HTN HART TAG DES HART DESCRIPTOR MSG HART MESSAGE DAT 01/01/93 DSN 0 VC1 3 VC2 4 VC3 5 VC4 0 RP 5		

9.6 FCO 05 RATIO-SET PID CONTROLLER

With: HI/Lo Process Alarms
Deviation Alarm
Tracking Setpoint
Setpoint Limits
4-20 mA Inputs/Output



CONFIGURATION PARAMETERS

	T	H	S	C
FB01	ESN 05	SRE NO	DV1 0 SEC	
FB02	ESN 07	SRE NO	DV2 0 SEC	
FB03	ESN 45	INA 17 INB 00		
FB07	ESN 08	INA 02 INB 00 INC 00 IND 00 RCD NO	R 1.00 RRL 0.50 RRH 1.50	
FB09	ESN 14	DSD NO INA 09	LL1 0.00% HL1 100.00%	
FB11	ESN 13	EO NO PU LP S1A SUS DSD NO INE 03 INI 22 INA 00		
FB12	ESN 15	Q1R 4 (%) Q2R 4 (%) Q3R 4 (%) Q4R 4 (%) A1T HI A2T LO A3T DEV A4T NONE INA 01 INB 01 INC 05 IND 01 A1I 0.0 SEC A2I 0.0 SEC A3I 0.0 SEC A4I 0.0 SEC A1O 0.0 SEC A2O 0.0 SEC	SA1 100.0% SA2 0.0% SA3 100.0% SA4 0.0% DA1 0.5% DA2 0.5% DA3 0.5% DA4 0.5% EA1 EN EA2 EN EA3 EN EA4 DIS	

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	T	H	S	C
FB12 (cont'd)	ESN 15	A3O 0.0 SEC A4O 0.0 SEC A1R NO A2R NO A3R NO A4R NO		
FB13	ESN 30	C1T PID MRT NO INP 01 INS 05 INF 17 INA 00 INC 18	A1 REV PG1 1.00 TI1 100 M/R TD1 0.00 MIN DG1 10.00 MR1 0.0% HL1 100.00% LL1 0.00%	
FB14	ESN 35	AO NO PU LP PUL NO INA 14 INT 00 INE 00 INS 00 INL 00	PUM 0.0%	
FB15	ESN 40	INP 01 INS 05 INV 17 INX 02 INY 00 INA 00 INL 00 PDR L SDR L HS1 VALVE HS2 VALVE HD1 YES HD2 YES SCF YES IN1 00 IN2 00 U1S U1 U2S U2	DP1 0.00 PL1 0.00 PH1 100.00 DP2 0.00 PL2 0.00 PH2 100.00 DPX 0.00 XL 0.00 XH 100.00 DPY 0.00 YL 0.00 YH 100.00 TST 10 SEC TSI TN1	

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	T	H	S	C
FB15 (cont'd)	ESN 40	TN1 TAG NAME 1 TN2 TAG NAME 2 EU1 PRCT EU2 PRCT EUX PRCT EUY PRCT FL1 A1 FL2 A2 FL3 A3 FL4 NONE FL5 NONE		
FB17	ESN 10	INT 01 INC 21 INL 00		
FB21	ESN 38	LT2 OR INA 18 INB 25		
FB98	ESN 90	H1P 01 H1S 05 H1V 17 H2P 00 H2S 00 H2V 00 POL 0 P1F USER P2F USER IND 00 INE 00 INF 00 ING 00 HTN HART TAG DES HART DESCRIPTOR MSG HART MESSAGE DAT 01/01/93 DSN 0 VC1 3 VC2 4 VC3 5 VC4 0 RP 5		

9.7 FCO 10 DEFAULT CONFIGURATION

CONFIGURATION PARAMETERS

	T	H	S	C
FB01	ESN 00	SRE NO	DV1 0 SEC	
FB02	ESN 00	SRE NO	DV2 0 SEC	
FB03	ESN 00	INA 00 INB 00		
FB04	ESN 00	INA 00		
FB05	ESN 00	INA 00		
FB06	ESN 00			
FB07	ESN 00	INA 00 INB 00 INC 00 IND 00 RCD NO	R 1.00 RRL 0.50 RRH 1.50	
FB08	ESN 00	OBR 5 (%) INA 00 INE 00 INC 00 IND 00 BCD NO	B 0.00%	
FB09	ESN 00	DSD NO INA 00	LL1 0.00% HL1 100.00%	
FB10	ESN 00	S1B HI S1C HI DSD NO INA 00 INB 00 INC 00		
FB11	ESN 00	EO NO PU LP S1A SUS DSD NO INE 00		

(continued on next page)

	T	H	S	C
FB11 (cont'd)	ESN 00	INI 00 INA 00		
FB12	ESN 00	Q1R 4 (%) Q2R 4 (%) Q3R 4 (%) Q4R 4 (%) A1T HI A2T LO A3T DEV A4T NONE INA 00 INB 00 INC 00 IND 00 A1I 0.0 SEC A2I 0.0 SEC A3I 0.0 SEC A4I 0.0 SEC A1O 0.0 SEC A2O 0.0 SEC A3O 0.0 SEC A4O 0.0 SEC A1R NO A2R NO A3R NO A4R NO	SA1 100.0% SA2 0.0% SA3 100.0% SA4 0.0% DA1 0.5% DA2 0.5% DA3 0.5% DA4 0.5% EA1 EN EA2 EN EA3 EN EA4 DIS	
FB13	ESN 00	C1T PID MRT NO INP 00 INS 00 INF 00 INA 00 INC 00	A1 REV PG1 1.00 TI1 100 M/R TD1 0.00 MIN DG1 10.00 MR1 0.0% HL1 100.00% LL1 0.00%	
FB14	ESN 00	AO NO PU LP PUL NO INA 00 INT 00 INE 00 INS 00 INL 00	PUM 0.0%	

	T	H	S	C
FB15	ESN 40	INP 00	DP1 0.00	
		INS 00	PL1 0.00	
		INV 00	PH1 100.00	
		INX 00	DP2 0.00	
		INY 00	PL2 0.00	
		INA 00	PH2 100.00	
		INL 00	DPX 0.00	
		PDR L	XL 0.00	
		SDR L	XH 100.00	
		HS1 VALVE	DPY 0.00	
		HS2 VALVE	YL 0.00	
		HD1 YES	YH 100.00	
		HD2 YES	TST 10 SEC	
		SCF YES	TSI TN1	
		IN1 00		
		IN2 00		
		U1S U1		
		U2S U2		
		TN1 TAG NAME 1		
		TN2 TAG NAME 2		
		EU1 PRCT		
		EU2 PRCT		
		EUX PRCT		
		EUY PRCT		
		FL1 NONE		
		FL2 NONE		
		FL3 NONE		
		FL4 NONE		
		FL5 NONE		
FB16	ESN 00	CU PRCT	FS 100	
		TDD NO	TB MIN	
		PCD NO	CM 1	
		INA 00	ZDO 0.0%	
		INS 00	SV 0	
		INR 00	P1 0	
			P2 0	
			DIR INC	
FB17	ESN 00	INT 00		
		INC 00		
		INL 00		

	T	H	S	C
FB18	ESN 00	INT 00 INC 00 HCD NO	H1 0.00%	
FB19	ESN 00	HCD NO	H2 0.00%	
FB20	ESN 00	LT1 AND INA 00 INB 00		
FB21	ESN 00	LT2 OR INA 00 INB 00		
FB22	ESN 00	INA 00 INB 00 INC 00	G1 1 B1 0	
FB23	ESN 00	EO NO PU LP S1A SUS DSD NO INE 00 INI 00 INA 00		
FB24	ESN 00	INA 00		
FB25	ESN 00	SRE NO	DV3 0 SEC	
FB28	ESN 00	INA 00 INS 00	FS 100 TB MIN CM 1 ZD 0.0% PW 106 MSEC	
FB29	ESN 00	INA 00 INB 00		
FB30	ESN 00			
FB32	ESN 00	INA 00 A1 DIR		

	T	H	S	C
FB33	ESN 00	INA 00 A2 DIR		
FB34	ESN 00	O1A MUL O1B DIV INA 00 INB 00 INC 00	GO1 1 GA1 1 GB1 1 GC1 1 BO1 0 BA1 0 BB1 0 BC1 0	
FB35	ESN 00	O2A MUL O2B DIV INA 00 INB 00 INC 00	GO2 1 GA2 1 GB2 1 GC2 1 BO2 0 BA2 0 BB2 0 BC2 0	
FB36	ESN 00	O3A MUL O3B DIV INA 00 INB 00 INC 00	GO3 1 GA3 1 GB3 1 GC3 1 BO3 0 BA3 0 BB3 0 BC3 0	
FB38	ESN 00	INA 00	GO5 1 GA5 1 BO5 0 BA5 0	
FB39	ESN 00	INA 00	GO6 1 GA6 1 BO6 0 BA6 0	
FB40	ESN 00	INA 00 INB 00	TL 0.00 MIN	
FB41	ESN 00	INA 00 INB 00	TH 0.00 MIN	

	T	H	S	C
FB42	ESN 00	INA 00	TRU 1.00 MIN	
		INB 00	TRD 1.00 MIN	
		INC 00		
		IND 00		
FB43	ESN 00	INA 00	TM 1 MIN	
		INB 00		
		INC 00		
FB44	ESN 00	INA 00	X0 0.00%	
			X1 10.00%	
			X2 20.00%	
			X3 30.00%	
			X4 40.00%	
			X5 50.00%	
			X6 60.00%	
			X7 70.00%	
			X8 80.00%	
			X9 90.00%	
			X10 100.00%	
			Y0 0.00%	
			Y1 10.00%	
			Y2 20.00%	
			Y3 30.00%	
			Y4 40.00%	
			Y5 50.00%	
			Y6 60.00%	
			Y7 70.00%	
			Y8 80.00%	
			Y9 90.00%	
			Y10 100.00%	
FB45	ESN 00	C2T PID	A2 REV	
		MRT NO	PG2 1.00	
		INP 00	TI2 100 M/R	
		INS 00	TD2 0.00 MIN	
		INF 00	DG2 10.00	
		INA 00	MR2 0.0%	
		INC 00	HL2 100.00%	
			LL2 0.00%	
FB46	ESN 00	INT 00		
		INC 00		

	T	H	S	C
FB47	ESN 00	INA 00	TF 0.00 MIN	
		INB 00	TN 0.00 MIN	
FB48	ESN 00	LT3 AND		
		INA 00		
		INB 00		
FB49	ESN 00	INA 00		
		INB 00		
		INC 00		
FB50	ESN 00	LT4 OR		
		INA 00		
		INB 00		
FB51	ESN 00	DSD NO	LL2 0.00%	
		INA 00	HL2 100.00%	
FB53	ESN 00	INA 00	BPL 0.0%	
FB55	ESN 00	AO NO	PUM 0.0%	
		PU LP		
		PUL NO		
		INA 00		
		INT 00		
		INE 00		
		INS 00		
FB61	ESN 00	LT5 AND		
		INA 00		
		INB 00		
FB62	ESN 00	LT6 OR		
		INA 00		
		INB 00		
FB64	ESN 00	C1A DIR	TC1 100.00%	
		C2A DIR	TC2 100.00%	
		C3A DIR	TC3 100.00%	
		C4A DIR	TC4 100.00%	
		INA 00	DC1 0.5%	
		INB 00	DC2 0.5%	
		INC 00	DC3 0.5%	

(continued on next page)

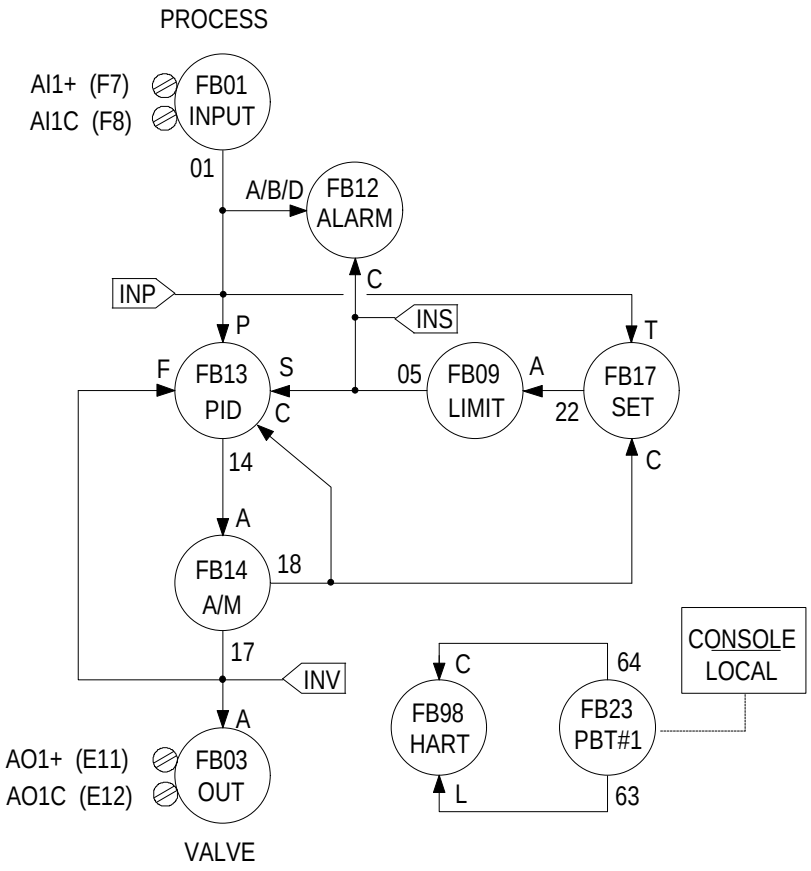
	T	H	S	C
FB64	ESN 00	IND 00	DC4 0.5%	
		INE 00		
		INF 00		
		ING 00		
		INH 00		
FB65	ESN 00	INA 00	DT 0.00 SEC	
		DTT OFF		
		OPU YES		
FB67	ESN 00	INA 00	OT 0.00 SEC	
FB71	ESN 00	INA 00		
		INB 00		
		IND 00		
		INE 00		
		INF 00		
		ING 00		
		INC 00		
FB72	ESN 00	INA 00	X0 0.00%	
			X1 10.00%	
			X2 20.00%	
			X3 30.00%	
			X4 40.00%	
			X5 50.00%	
			X6 60.00%	
			X7 70.00%	
			X8 80.00%	
			X9 90.00%	
			X10 100.00%	
			Y0 0.00%	
			Y1 10.00%	
			Y2 20.00%	
			Y3 30.00%	
			Y4 40.00%	
			Y5 50.00%	
			Y6 60.00%	
			Y7 70.00%	
			Y8 80.00%	
			Y9 90.00%	
			Y10 100.00%	

	T	H	S	C
FB73	ESN 00	Q5R 4 (%)	SA5 100.0%	
		Q6R 4 (%)	SA6 0.0%	
		Q7R 4 (%)	SA7 100.0%	
		Q8R 4 (%)	SA8 0.0%	
		A5T HI	DA5 0.5%	
		A6T LO	DA6 0.5%	
		A7T DEV	DA7 0.5%	
		A8T NONE	DA8 0.5%	
		INA 00	EA5 EN	
		INB 00	EA6 EN	
		INC 00	EA7 EN	
		IND 00	EA8 DIS	
		A5I 0.0 SEC		
		A6I 0.0 SEC		
		A7I 0.0 SEC		
		A8I 0.0 SEC		
		A5O 0.0 SEC		
		A6O O.O SEC		
		A7O 0.0 SEC		
		A8O 0.0 SEC		
		A5R NO		
		A6R NO		
		A7R NO		
		A8R NO		
FB75	ESN 00	TPW ____		
		APW ____		
		SPW ____		
		HPW ____		
		CPW ____		
FB81	ESN 00	SRE NO	DVP 0 SEC	
			MVU *	
			MVL *	
			MVH *	
FB82	ESN 00	IT *	DVP 0 SEC	
		BOD UP	MVU *	
			MVL *	
			MVH *	
FB85	ESN 00	SRE NO	DV1 0 SEC	
FB86	ESN 00	SRE NO	DV2 0 SEC	

	T	H	S	C
FB88	ESN 00	LT7 AND INA 00 INB 00		
FB89	ESN 00	LT8 AND INA 00 INB 00		
FB90	ESN 00	LT9 AND INA 00 INB 00		
FB98	ESN 00	H1P 00 H1S 00 H1V 00 H2P 00 H2S 00 H2V 00 POL 0 P1F USER P2F USER IND 00 INE 00 INF 00 ING 00 HTN HART TAG DES HART DESCRIPTOR MSG HART MESSAGE DAT 01/01/93 DSN 0 VC1 3 VC2 4 VC3 5 VC4 0 RP 5		

9.8 FCO 11 SINGLE-LOOP PID CONTROLLER (TSP) C/L OPERATION

With: Hi/Lo Process Alarms
Deviation Alarm
Tracking Setpoint
Setpoint Limits
4-20 mA Input/Output



CONFIGURATION PARAMETERS

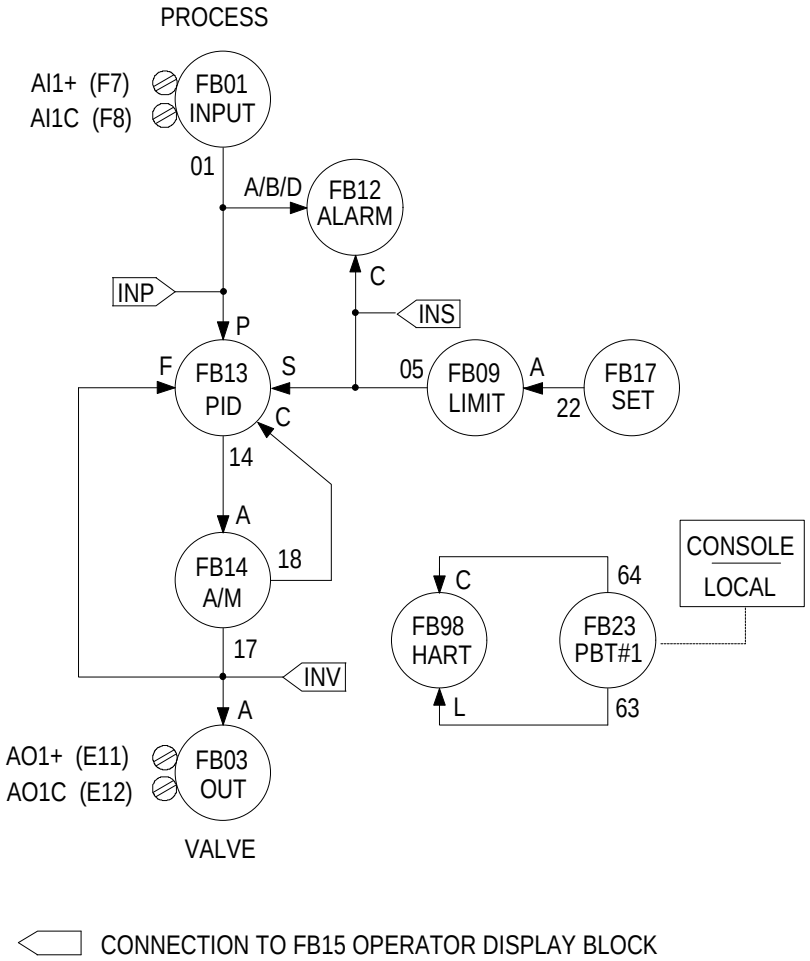
	T	H	S	C
FB01	ESN 05	SRE NO	DV1 0 SEC	
FB03	ESN 45	INA 17 INB 00		
FB09	ESN 14	DSD NO INA 22	LL1 0.00% HL1 100.00%	
FB12	ESN 15	Q1R 4 (%) Q2R 4 (%) Q3R 4 (%) Q4R 4 (%) A1T HI A2T LO A3T DEV A4T NONE INA 01 INB 01 INC 05 IND 01 A1I 0.0 SEC A2I 0.0 SEC A3I 0.0 SEC A4I 0.0 SEC A1O 0.0 SEC A2O 0.0 SEC A3O 0.0 SEC A4O 0.0 SEC A1R NO A2R NO A3R NO A4R NO	SA1 100.0% SA2 0.0% SA3 100.0% SA4 0.0% DA1 0.5% DA2 0.5% DA3 0.5% DA4 0.5% EA1 EN EA2 EN EA3 EN EA4 DIS	
FB13	ESN 30	C1T PID MRT NO INP 01 INS 05 INF 17 INA 00 INC 18	A1 REV PG1 1.00 TI1 100 M/R TD1 0.00 MIN DG1 10.00 MR1 0.0% HL1 100.00% LL1 0.0%	

	T	H	S	C
FB14	ESN 35	AO NO	PUM 0.0%	
		PU LP		
		PUL NO		
		INA 14		
		INT 00		
		INE 00		
		INS 00		
		INL 00		
FB15	ESN 40	INP 01	DP1 0.00	
		INS 05	PL1 0.00	
		INV 17	PH1 100.00	
		INX 00	DP2 0.00	
		INY 00	PL2 0.00	
		INA 00	PH2 100.00	
		INL 00	DPX 0.00	
		PDR L	XL 0.00	
		SDR L	XH 100.00	
		HS1 VALVE	DPY 0.00	
		HS2 VALVE	YL 0.00	
		HD1 YES	YH 100.00	
		HD2 YES	TST 10 SEC	
		SCF YES	TSI TN1	
		IN1 00		
		IN2 00		
		U1S U1		
		U2S U2		
		TN1 TAG NAME 1		
		TN2 TAG NAME 2		
		EU1 PRCT		
		EU2 PRCT		
		EUX PRCT		
		EUY PRCT		
		FL1 A1		
		FL2 A2		
		FL3 A3		
		FL4 NONE		
		FL5 NONE		
FB17	ESN 10	INT 01		
		INC 18		
		INL 00		

	T	H	S	C
FB23	ESN 86	EO NO PU LP S1A SUS DSD NO INE 00 INI 00 INA 00		
FB98	ESN 90	H1P 01 H1S 05 H1V 17 H2P 00 H2S 00 H2V 00 POL 0 P1F CL P2F USER IND 00 INE 00 INF 00 ING 00 HTN HART TAG DES HART DESCRIPTOR MSG HART MESSAGE DAT 01/01/93 DSN 0 VC1 3 VC2 4 VC3 5 VC4 0 RP 5		

9.9 FCO 12 SINGLE-LOOP PID CONTROLLER (NTSP)- C/L OPERATION

With: Hi/Lo Process Alarms
Deviation Alarm
Non-Tracking Setpoint
Setpoint Limits
4-20 mA Input/Output



CONFIGURATION PARAMETERS

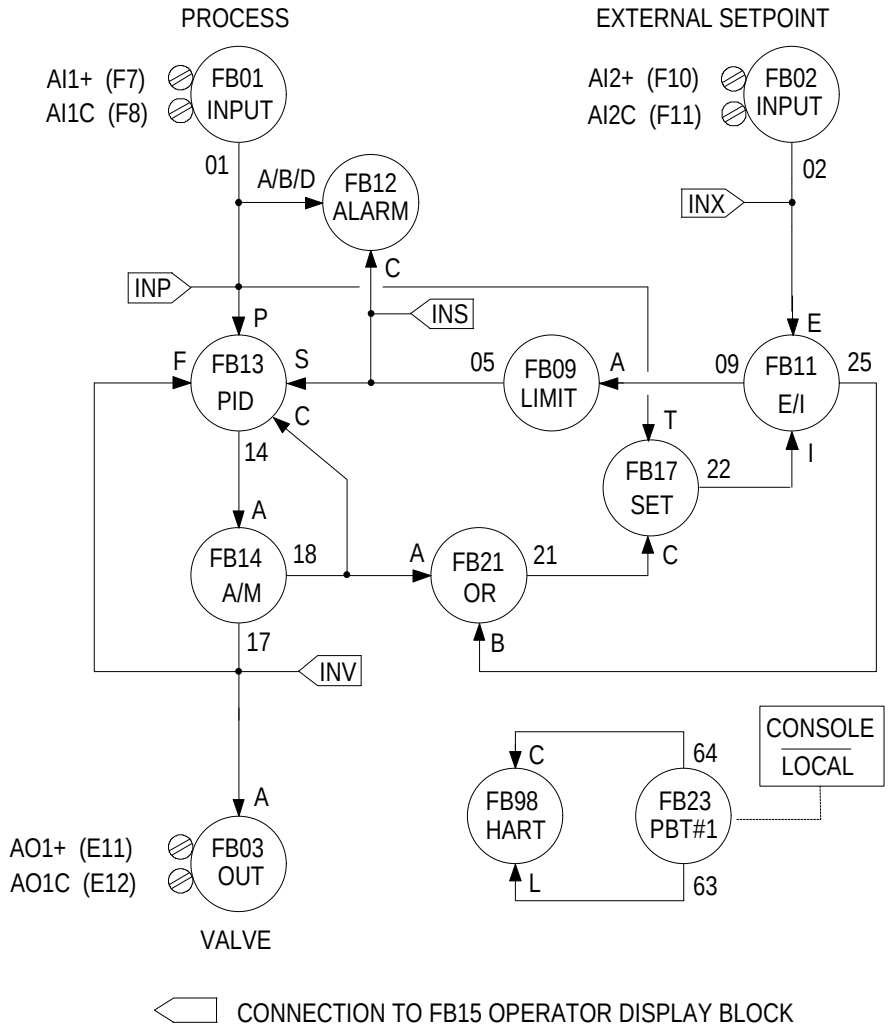
	T	H	S	C
FB01	ESN 05	SRE NO	DV1 0 SEC	
FB03	ESN 45	INA 17 INB 00		
FB09	ESN 14	DSD NO INA 22	LL1 0.00% HL1 100.00%	
FB12	ESN 15	Q1R 4 (%) Q2R 4 (%) Q3R 4 (%) Q4R 4 (%) A1T HI A2T LO A3T DEV A4T NONE INA 01 INB 01 INC 05 IND 01 A1I 0.0 SEC A2I 0.0 SEC A3I 0.0 SEC A4I 0.0 SEC A1O 0.0 SEC A2O 0.0 SEC A3O 0.0 SEC A4O 0.0 SEC A1R NO A2R NO A3R NO A4R NO	SA1 100.0% SA2 0.0% SA3 100.0% SA4 0.0% DA1 0.5% DA2 0.5% DA3 0.5% DA4 0.5% EA1 EN EA2 EN EA3 EN EA4 DIS	
FB13	ESN 30	C1T PID MRT NO INP 01 INS 05 INF 17 INA 00 INC 18	A1 REV PG1 1.00 TI1 100 M/R TD1 0.00 MIN DG1 10.00 MR1 0.0% HL1 100.00% LL1 0.0%	

	T	H	S	C
FB14	ESN 35	AO NO	PUM 0.0%	
		PU LP		
		PUL NO		
		INA 14		
		INT 00		
		INE 00		
		INS 00		
		INL 00		
FB15	ESN 40	INP 01	DP1 0.00	
		INS 05	PL1 0.00	
		INV 17	PH1 100.00	
		INX 00	DP2 0.00	
		INY 00	PL2 0.00	
		INA 00	PH2 100.00	
		INL 00	DPX 0.00	
		PDR L	XL 0.00	
		SDR L	XH 100.00	
		HS1 VALVE	DPY 0.00	
		HS2 VALVE	YL 0.00	
		HD1 YES	YH 100.00	
		HD2 YES	TST 10 SEC	
		SCF YES	TSI TN1	
		IN1 00		
		IN2 00		
		U1S U1		
		U2S U2		
		TN1 TAG NAME 1		
		TN2 TAG NAME 2		
		EU1 PRCT		
		EU2 PRCT		
		EUX PRCT		
		EUY PRCT		
		FL1 A1		
		FL2 A2		
		FL3 A3		
		FL4 NONE		
		FL5 NONE		
FB17	ESN 10	INT 00		
		INC 00		
		INL 00		

	T	H	S	C
FB23	ESN 86	EO NO		
		PU LP		
		S1A SUS		
		DSD NO		
		INE 00		
		INI 00		
		INA 00		
FB98	ESN 90	H1P 01		
		H1S 05		
		H1V 17		
		H2P 00		
		H2S 00		
		H2V 00		
		POL 0		
		P1F CL		
		P2F USER		
		IND 00		
		INE 00		
		INF 00		
		ING 00		
		HTN HART TAG		
		DES HART DESCRIPTOR		
		MSG HART MESSAGE		
		DAT 01/01/93		
		DSN 0		
		VC1 3		
		VC2 4		
		VC3 5		
		VC4 0		
		RP 5		

9.10 FCO 13 EXTERNAL-SET PID CONTROLLER (TSP) - C/L OPERATION

With: Hi/Lo Process Alarms
Deviation Alarm
Tracking Setpoint
Setpoint Limits
4-20 mA Inputs/Output



CONFIGURATION PARAMETERS

	T	H	S	C
FB01	ESN 05	SRE NO	DV1 0 SEC	
FB02	ESN 07	SRE NO	DV2 0 SEC	
FB03	ESN 45	INA 17 INB 00		
FB09	ESN 14	DSD NO INA 09	LL1 0.00% HL1 100.00%	
FB11	ESN 13	EO NO PU LP S1A SUS DSD NO INE 02 INI 22 INA 00		
FB12	ESN 15	Q1R 4 (%) Q2R 4 (%) Q3R 4 (%) Q4R 4 (%) A1T HI A2T LO A3T DEV A4T NONE INA 01 INB 01 INC 05 IND 01 A1I 0.0 SEC A2I 0.0 SEC A3I 0.0 SEC A4I 0.0 SEC A1O 0.0 SEC A2O 0.0 SEC A3O 0.0 SEC A4O 0.0 SEC A1R NO A2R NO A3R NO A4R NO	SA1 100.0% SA2 0.0% SA3 100.0% SA4 0.0% DA1 0.5% DA2 0.5% DA3 0.5% DA4 0.5% EA1 EN EA2 EN EA3 EN EA4 DIS	

	T	H	S	C
FB13	ESN 30	C1T PID	A1 REV	
		MRT NO	PG1 1.00	
		INP 01	TI1 100 M/R	
		INS 05	TD1 0.00 MIN	
		INF 17	DG1 10.00	
		INA 00	MR1 0.0%	
		INC 18	HL1 100.00%	
			LL1 0.0%	
FB14	ESN 35	AO NO	PUM 0.0%	
		PU LP		
		PUL NO		
		INA 14		
		INT 00		
		INE 00		
		INS 00		
		INL 00		
FB15	ESN 40	INP 01	DP1 0.00	
		INS 05	PL1 0.00	
		INV 17	PH1 100.00	
		INX 02	DP2 0.00	
		INY 00	PL2 0.00	
		INA 00	PH2 100.00	
		INL 00	DPX 0.00	
		PDR L	XL 0.00	
		SDR L	XH 100.00	
		HS1 VALVE	DPY 0.00	
		HS2 VALVE	YL 0.00	
		HD1 YES	YH 100.00	
		HD2 YES	TST 10 SEC	
		SCF YES	TSI TN1	
		IN1 00		
		IN2 00		
		U1S U1		
		U2S U2		
		TN1 TAG NAME 1		
		TN2 TAG NAME 2		
		EU1 PRCT		
		EU2 PRCT		
		EUX PRCT		
		EUY PRCT		
		FL1 A1		

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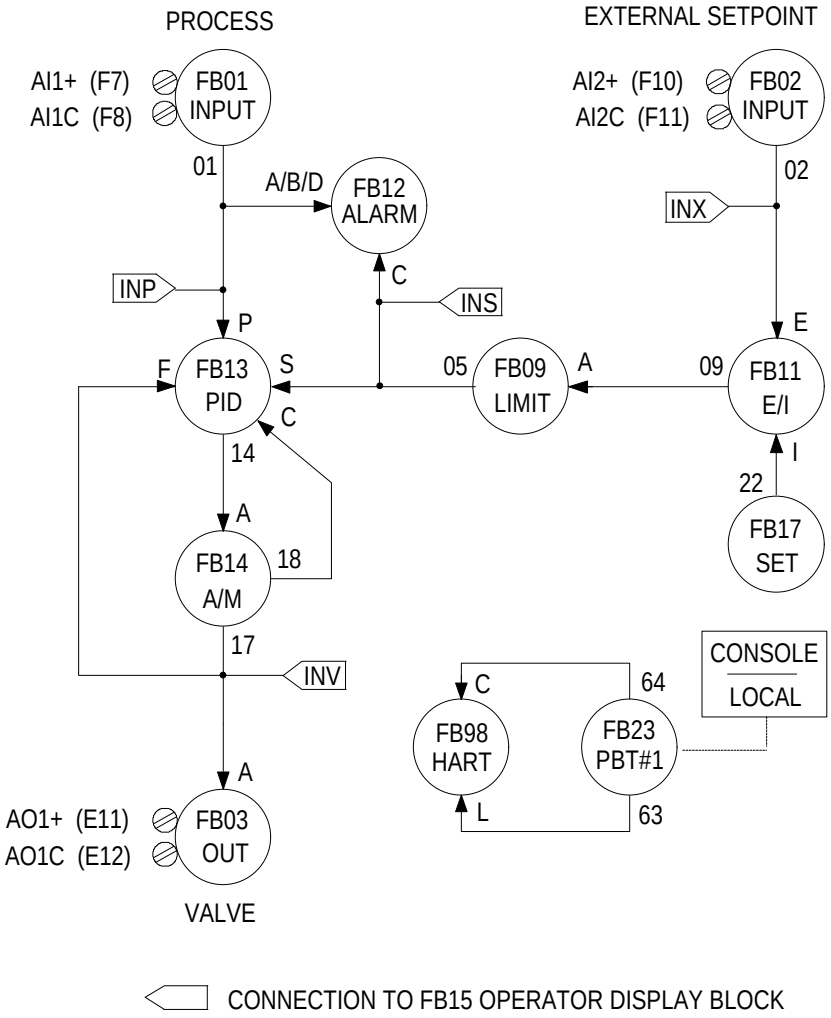
	T	H	S	C
FB15	ESN 40	FL2 A2 FL3 A3 FL4 NONE FL5 NONE		
FB17	ESN 10	INT 01 INC 21 INL 00		
FB21	ESN 38	LT2 OR INA 18 INB 25		
FB23	ESN 86	EO NO PU LP S1A SUS DSD NO INE 00 INI 00 INA 00		
FB98	ESN 90	H1P 01 H1S 05 H1V 17 H2P 00 H2S 00 H2V 00 POL 0 P1F CL P2F L1EI IND 00 INE 00 INF 00 ING 00 HTN HART TAG DES HART DESCRIPTOR MSG HART MESSAGE DAT 01/01/93 DSN 0 VC1 3 VC2 4 VC3 5 VC4 0 RP 5		

9.11 FCO 14 EXTERNAL SET PID CONTROLLER (NTSP) - C/L OPERATION

With: Hi/Lo Process Alarms
Deviation Alarm
Non-Tracking Setpoint
Setpoint Limits
4-20 mA Inputs/Output



CONFIGURATION PARAMETERS

	T	H	S	C
FB01	ESN 05	SRE NO	DV1 0 SEC	
FB02	ESN 07	SRE NO	DV2 0 SEC	
FB03	ESN 45	INA 17 INB 00		
FB09	ESN 14	DSD NO INA 09	LL1 0.00% HL1 100.00%	
FB11	ESN 13	EO NO PU LP S1A SUS DSD NO INE 02 INI 22 INA 00		
FB12	ESN 15	Q1R 4 (%) Q2R 4 (%) Q3R 4 (%) Q4R 4 (%) A1T HI A2T LO A3T DEV A4T NONE INA 01 INB 01 INC 05 IND 01 A1I 0.0 SEC A2I 0.0 SEC A3I 0.0 SEC A4I 0.0 SEC A1O 0.0 SEC A2O 0.0 SEC A3O 0.0 SEC A4O 0.0 SEC A1R NO A2R NO A3R NO A4R NO	SA1 100.0% SA2 0.0% SA3 100.0% SA4 0.0% DA1 0.5% DA2 0.5% DA3 0.5% DA4 0.5% EA1 EN EA2 EN EA3 EN EA4 DIS	

	T	H	S	C
FB13	ESN 30	C1T PID	A1 REV	
		MRT NO	PG1 1.00	
		INP 01	TI1 100 M/R	
		INS 05	TD1 0.00 MIN	
		INF 17	DG1 10.00	
		INA 00	MR1 0.0%	
		INC 18	HL1 100.00%	
			LL1 0.00%	
FB14	ESN 35	AO NO	PUM 0.0%	
		PU LP		
		PUL NO		
		INA 14		
		INT 00		
		INE 00		
		INS 00		
		INL 00		
FB15	ESN 40	INP 01	DP1 0.00	
		INS 05	PL1 0.00	
		INV 17	PH1 100.00	
		INX 02	DP2 0.00	
		INY 00	PL2 0.00	
		INA 00	PH2 100.00	
		INL 00	DPX 0.00	
		PDR L	XL 0.00	
		SDR L	XH 100.00	
		HS1 V	DPY 0.00	
		HS2 V	YL 0.00	
		HD1 YES	YH 100.00	
		HD2 YES	TST 10 SEC	
		SCF YES	TSI TN1	
		IN1 00		
		IN2 00		
		U1S U1		
		U2S U2		
		TN1 TAG NAME 1		
		TN2 TAG NAME 2		
		EU1 PRCT		
		EU2 PRCT		
		EUX PRCT		
		EUY PRCT		
		FL1 A1		

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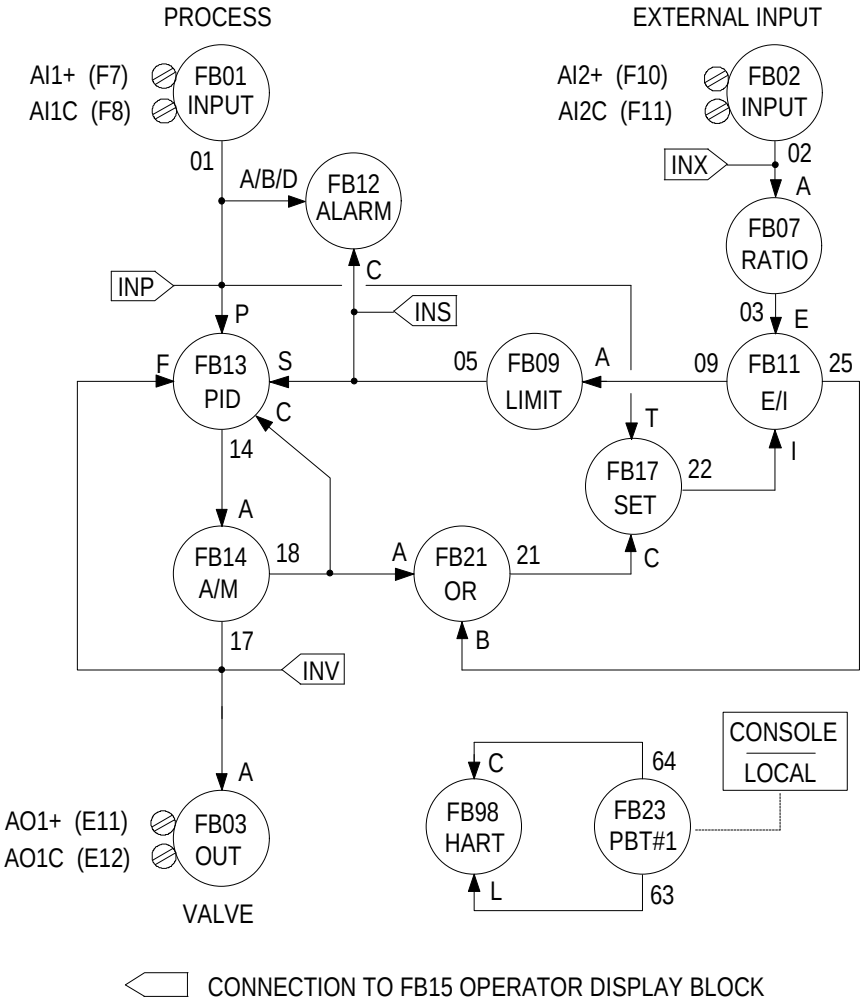
	T	H	S	C
FB15	ESN 40	FL2 A2 FL3 A3 FL4 NONE FL5 NONE		
FB17	ESN 10	INT 00 INC 00 INL 00		
FB23	ESN 86	EO NO PU LP S1A SUS DSD NO INE 00 INI 00 INA 00		
FB98	ESN 90	H1P 01 H1S 05 H1V 17 H2P 00 H2S 00 H2V 00 POL 0 P1F CL P2F L1EI IND 00 INE 00 INF 00 ING 00 HTN HART TAG DES HART DESCRIPTOR MSG HART MESSAGE DAT 01/01/93 DSN 0 VC1 3 VC2 4 VC3 5 VC4 0 RP 5		

9.12 FCO 15 RATIO SET PID CONTROLLER - C/L OPERATION

With: Hi/Lo Process Alarms
Deviation Alarm
Tracking Setpoint
Setpoint Limits
4-20 mA Inputs/Output



CONFIGURATION PARAMETERS

	T	H	S	C
FB01	ESN 05	SRE NO	DV1 0 SEC	
FB02	ESN 07	SRE NO	DV2 0 SEC	
FB03	ESN 45	INA 17 INB 00		
FB07	ESN 08	INA 02 INB 00 INC 00 IND 00 RCD NO	R 1.00 RRL 0.50 RRH 1.50	
FB09	ESN 14	DSD NO INA 09	LL1 0.00% HL1 100.00%	
FB11	ESN 13	EO NO PU LP S1A SUS DSD NO INE 03 INI 22 INA 00		
FB12	ESN 15	Q1R 4 (%) Q2R 4 (%) Q2R 4 (%) Q4R 4 (%) A1T HI A2T LO A3T DEV A4T NONE INA 01 INB 01 INC 05 IND 01 A1I 0.0 SEC A2I 0.0 SEC A3I 0.0 SEC A4I 0.0 SEC A1O 0.0 SEC A2O 0.0 SEC	SA1 100.0% SA2 0.0% SA3 100.0% SA4 0.0% DA1 0.5% DA2 0.5% DA3 0.5% DA4 0.5% EA1 EN EA2 EN EA3 EN EA4 DIS	

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	T	H	S	C
FB12 (cont'd)	ESN 15	A3O 0.0 SEC A4O 0.0 SEC A1R NO A2R NO A3R NO A4R NO		
FB13	ESN 30	C1T PID MRT NO INP 01 INS 05 INF 17 INA 00 INC 18	A1 REV PG1 1.00 TI1 100 M/R TD1 0.00 MIN DG1 10.00 MR1 0.0% HL1 100.00% LL1 0.0%	
FB14	ESN 35	AO NO PU LP PUL NO INA 14 INT 00 INE 00 INS 00 INL 00	PUM 0.0%	
FB15	ESN 40	INP 01 INS 05 INV 17 INX 02 INY 00 INA 00 INL 00 PDR L SDR L HS1 VALVE HS2 VALVE HD1 YES HD2 YES SCF YES IN1 00 IN2 00 U1S U1 U2S U2	DP1 0.00 PL1 0.00 PH1 100.00 DP2 0.00 PL2 0.00 PH2 100.00 DPX 0.00 XL 0.00 XH 100.00 DPY 0.00 YL 0.00 YH 100.00 TST 10 SEC TSI TN1	

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	T	H	S	C
FB15	ESN 40	TN1 TAG NAME 1		
		TN2 TAG NAME 2		
		EU1 PRCT		
		EU2 PRCT		
		EUX PRCT		
		EUY PRCT		
		FL1 A1		
		FL2 A2		
		FL3 A3		
		FL4 NONE		
		FL5 NONE		
FB17	ESN 10	INT 01		
		INC 21		
		INL 00		
FB21	ESN 38	LT2 OR		
		INA 18		
		INB 25		
FB23	ESN 86	EO NO		
		PU LP		
		S1A SUS		
		DSD NO		
		INE 00		
		INI 00		
		INA 00		
FB98	ESN 90	H1P 01		
		H1S 05		
		H1V 17		
		H2P 00		
		H2S 00		
		H2V 00		
		POL 0		
		P1F CL		
		P2F L1EI		
		IND 00		
		INE 00		
		INF 00		
		ING 00		
		HTN HART TAG		
		DES HART DESCRIPTOR		

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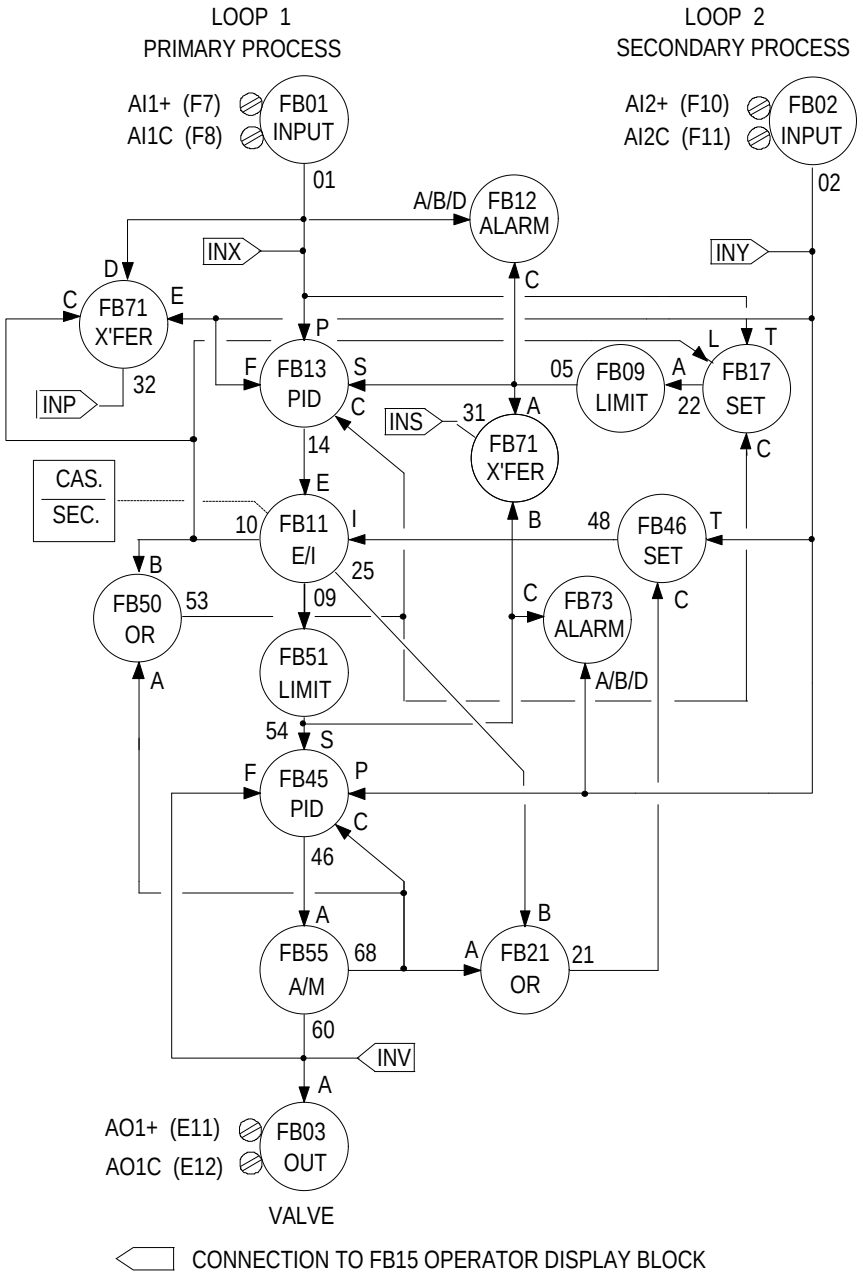
T	H	S	C
FB98 ESN 90	MSG HART MESSAGE DAT 01/01/93 DSN 0 VC1 3 VC2 4 VC3 5 VC4 0 RP 5		

9.13 FCO 20 SINGLE STATION CASCADE PID CONTROLLER (TSP)

With: Hi/Lo Process Alarms (Both Loops)
Deviation Alarm (Both Loops)
Tracking Setpoints (Both Loops)
Setpoint Limits (Both Loops)
4-20 mA Inputs/Output



CONFIGURATION PARAMETERS

	T	H	S	C
FB01	ESN 05	SRE NO	DV1 0 SEC	
FB02	ESN 07	SRE NO	DV2 0 SEC	
FB03	ESN 70	INA 60 INB 00		
FB09	ESN 44	DSD NO INA 22	LL1 0.00% HL1 100.00%	
FB11	ESN 55	EO NO PU LP S1A SUS DSD NO INE 14 INI 48 INA 00		
FB12	ESN 77	Q1R 4 (%) Q2R 4 (%) Q3R 4 (%) Q4R 4 (%) A1T HI A2T LO A3T DEV A4T NONE INA 01 INB 01 INC 05 IND 01 A1I 0.0 SEC A2I 0.0 SEC A3I 0.0 SEC A4I 0.0 SEC A1O 0.0 SEC A2O 0.0 SEC A3O 0.0 SEC A4O 0.0 SEC A1R NO A2R NO A3R NO A4R NO	SA1 100.0% SA2 0.0% SA3 100.0% SA4 0.0% DA1 0.5% DA2 0.5% DA3 0.5% DA4 0.5% EA1 EN EA2 EN EA3 EN EA4 DIS	

	T	H	S	C
FB13	ESN 45	C1T PID	A1 REV	
		MRT NO	PG1 1.00	
		INP 01	TI1 100 M/R	
		INS 05	TD1 0.00 MIN	
		INF 02	DG1 10.00	
		INA 00	MR1 0.0%	
		INC 53	HL1 100.00%	
			LL1 0.00%	
FB15	ESN 40	INP 32	DP1 0.00	
		INS 31	PL1 0.00	
		INV 60	PH1 100.00	
		INX 01	DP2 0.00	
		INY 02	PL2 0.00	
		INA 00	PH2 100.00	
		INL 10	DPX 0.00	
		PDR L	XL 0.00	
		SDR L	XH 100.00	
		HS1 VALVE	DPY 0.00	
		HS2 VALVE	YL 0.00	
		HD1 YES	YH 100.00	
		HD2 YES	TST 10 SEC	
		SCF YES	TSI BOTH	
		IN1 00		
		IN2 00		
		U1S U1		
		U2S U2		
		TN1 PRIMARY		
		TN2 SECONDARY		
		EU1 PRCT		
		EU2 PRCT		
		EUX PRCT		
		EUY PRCT		
		FL1 A1		
		FL2 A2		
		FL3 A5		
		FL4 A6		
		FL5 NONE		
FB17	ESN 43	INT 01		
		INC 53		
		INL 10		

	T	H	S	C
FB21	ESN 20	LT2 OR INA 68 INB 25		
FB45	ESN 60	C2T PID MRT NO INP 02 INS 54 INF 60 INA 00 INC 68	A2 REV PG2 1.00 TI2 100 M/R TD2 0.00 MIN DG2 10.00 MR2 0.0% HL2 100.00% LL2 0.00%	
FB46	ESN 53	INT 02 INC 21		
FB50	ESN 15	LT4 OR INA 68 INB 10		
FB51	ESN 56	DSD NO INA 09	LL2 0.00% HL2 100.00%	
FB55	ESN 65	AO NO PU LP PUL NO INA 46 INT 00 INE 00 INS 00	PUM 0.0%	
FB71	ESN 36	INA 05 INB 54 IND 01 INE 02 INF 00 ING 00 INC 10		
FB73	ESN 78	Q5R 4 (%) Q6R 4 (%) Q7R 4 (%) Q8R 4 (%)	SA5 100.0% SA6 0.0% SA7 100.0% SA8 0.0%	

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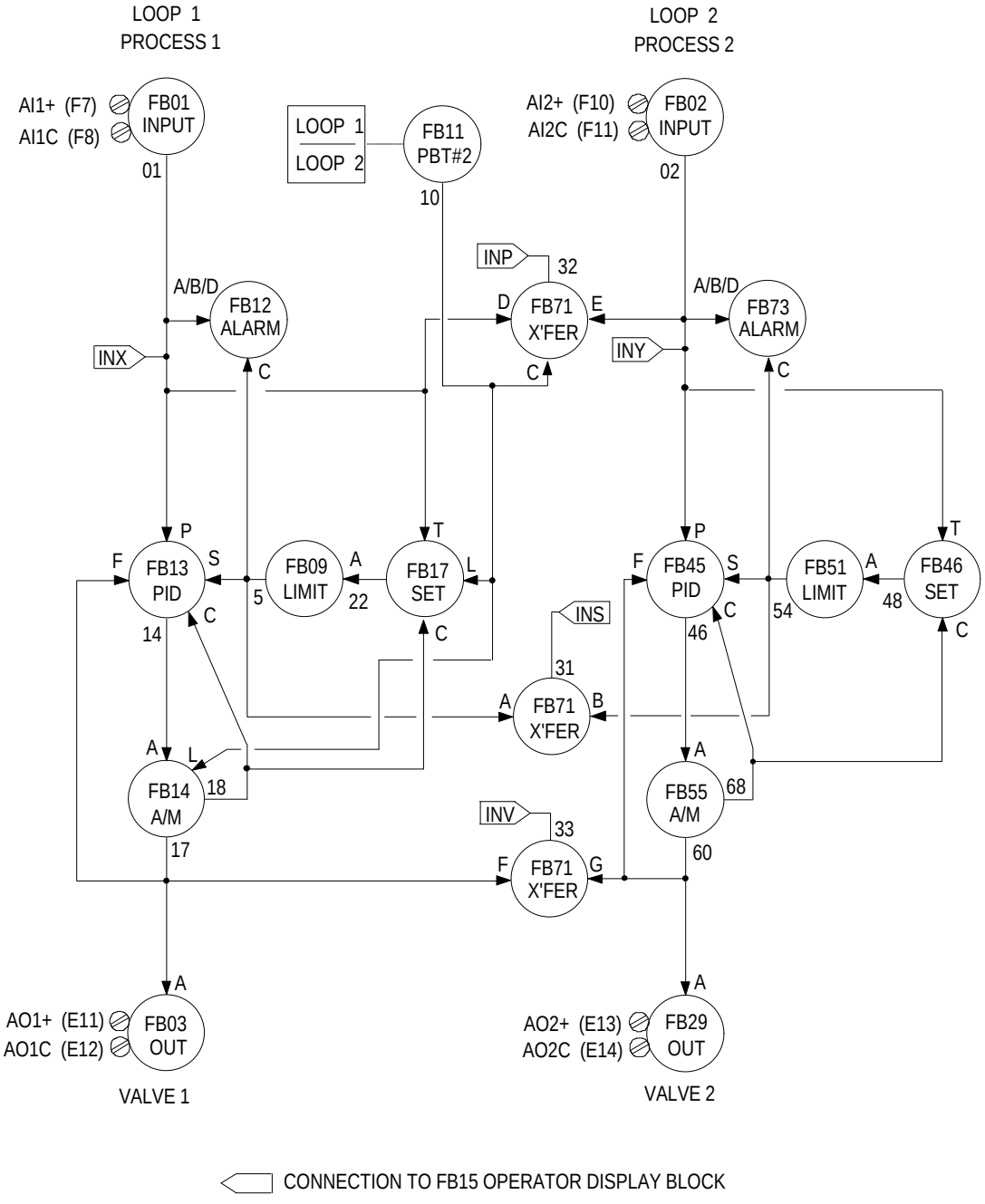
	T	H	S	C
FB73	ESN 78	A5T HI	DA5 0.5%	
		A6T LO	DA6 0.5%	
		A7T DEV	DA7 0.5%	
		A8T NONE	DA8 0.5%	
		INA 02	EA5 EN	
		INB 02	EA6 EN	
		INC 54	EA7 EN	
		IND 02	EA8 DIS	
		A5I 0.0 SEC		
		A6I 0.0 SEC		
		A7I 0.0 SEC		
		A8I 0.0 SEC		
		A5O 0.0 SEC		
		A6O O.O SEC		
		A7O 0.0 SEC		
		A8O 0.0 SEC		
		A5R NO		
		A6R NO		
		A7R NO		
		A8R NO		
FB98	ESN 90	H1P 01		
		H1S 05		
		H1V 14		
		H2P 02		
		H2S 54		
		H2V 60		
		POL 0		
		P1F USER		
		P2F L1EI		
		IND 00		
		INE 00		
		INF 00		
		ING 00		
		HTN HART TAG		
		DES HART DESCRIPTOR		
		MSG HART MESSAGE		
		DAT 01/01/93		
		DSN 0		
		VC1 3		
		VC2 4		
		VC3 5		
		VC4 0		
		RP 5		

9.14 FCO 25 2-LOOP PID CONTROLLER (TSP)

With: Hi/Lo Process Alarms (Both Loops)
Deviation Alarm (Both Loops)
Tracking Setpoints (Both Loops)
Setpoint Limits (Both Loops)
4-20 mA Inputs/Output
Model 348E Required for FCO25



CONFIGURATION PARAMETERS

	T	H	S	C
FB01	ESN 05	SRE NO	DV1 0 SEC	
FB02	ESN 07	SRE NO	DV2 0 SEC	
FB03	ESN 70	INA 17 INB 00		
FB09	ESN 34	DSD NO INA 22	LL1 0.00% HL1 100.00%	
FB11	ESN 55	EO NO PU LP S1A SUS DSD NO INE 00 INI 00 INA 00		
FB12	ESN 75	Q1R 4 (%) Q2R 4 (%) Q3R 4 (%) Q4R 4 (%) A1T HI A2T LO A3T DEV A4T NONE INA 01 INB 01 INC 05 IND 01 A1I 0.0 SEC A2I 0.0 SEC A3I 0.0 SEC A4I 0.0 SEC A1O 0.0 SEC A2O 0.0 SEC A3O 0.0 SEC A4O 0.0 SEC A1R NO A2R NO A3R NO A4R NO	SA1 100.0% SA2 0.0% SA3 100.0% SA4 0.0% DA1 0.5% DA2 0.5% DA3 0.5% DA4 0.5% EA1 EN EA2 EN EA3 EN EA4 DIS	

	T	H	S	C
FB13	ESN 60	C1T PID	A1 REV	
		MRT NO	PG1 1.00	
		INP 01	TI1 100 M/R	
		INS 05	TD1 0.00 MIN	
		INF 17	DG1 10.00	
		INA 00	MR1 0.0%	
		INC 18	HL1 100.00%	
			LL1 0.0%	
FB14	ESN 65	AO NO	PUM 0.0%	
		PU LP		
		PUL NO		
		INA 14		
		INT 00		
		INE 00		
		INS 00		
		INL 10		
FB15	ESN 40	INP 32	DP1 0.00	
		INS 31	PL1 0.00	
		INV 33	PH1 100.00	
		INX 01	DP2 0.00	
		INY 02	PL2 0.00	
		INA 00	PH2 100.00	
		INL 10	DPX 0.00	
		PDR L	XL 0.00	
		SDR L	XH 100.00	
		HS1 VALVE	DPY 0.00	
		HS2 VALVE	YL 0.00	
		HD1 YES	YH 100.00	
		HD2 YES	TST 10 SEC	
		SCF YES	TSI BOTH	
		IN1 00		
		IN2 00		
		U1S U1		
		U2S U2		
		TN1 LOOP 1		
		TN2 LOOP 2		
		EU1 PRCT		
		EU2 PRCT		
		EUX PRCT		
		EUY PRCT		
		FL1 A1		

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	T	H	S	C
FB15 (cont'd)	ESN 40	FL2 A2 FL3 A5 FL4 A6 FL5 NONE		
FB17	ESN 30	INT 01 INC 18 INL 10		
FB29	ESN 71	INA 60 INB 00		
FB45	ESN 45	C2T PID MRT NO INP 02 INS 54 INF 60 INA 00 INC 68	A2 REV PG2 1.00 TI2 100 M/R TD2 0.00 MIN DG2 10.00 MR2 0.0% HL2 100.00% LL2 0.0%	
FB46	ESN 25	INT 02 INC 68		
FB51	ESN 26	DSD NO INA 48	LL2 0.00% HL2 100.00%	
FB55	ESN 66	AO NO PU LP PUL NO INA 46 INT 00 INE 00 INS 00	PUM 0.0%	
FB71	ESN 36	INA 05 INB 54 IND 01 INE 02 INF 17 ING 60 INC 10		

(continued on next page)

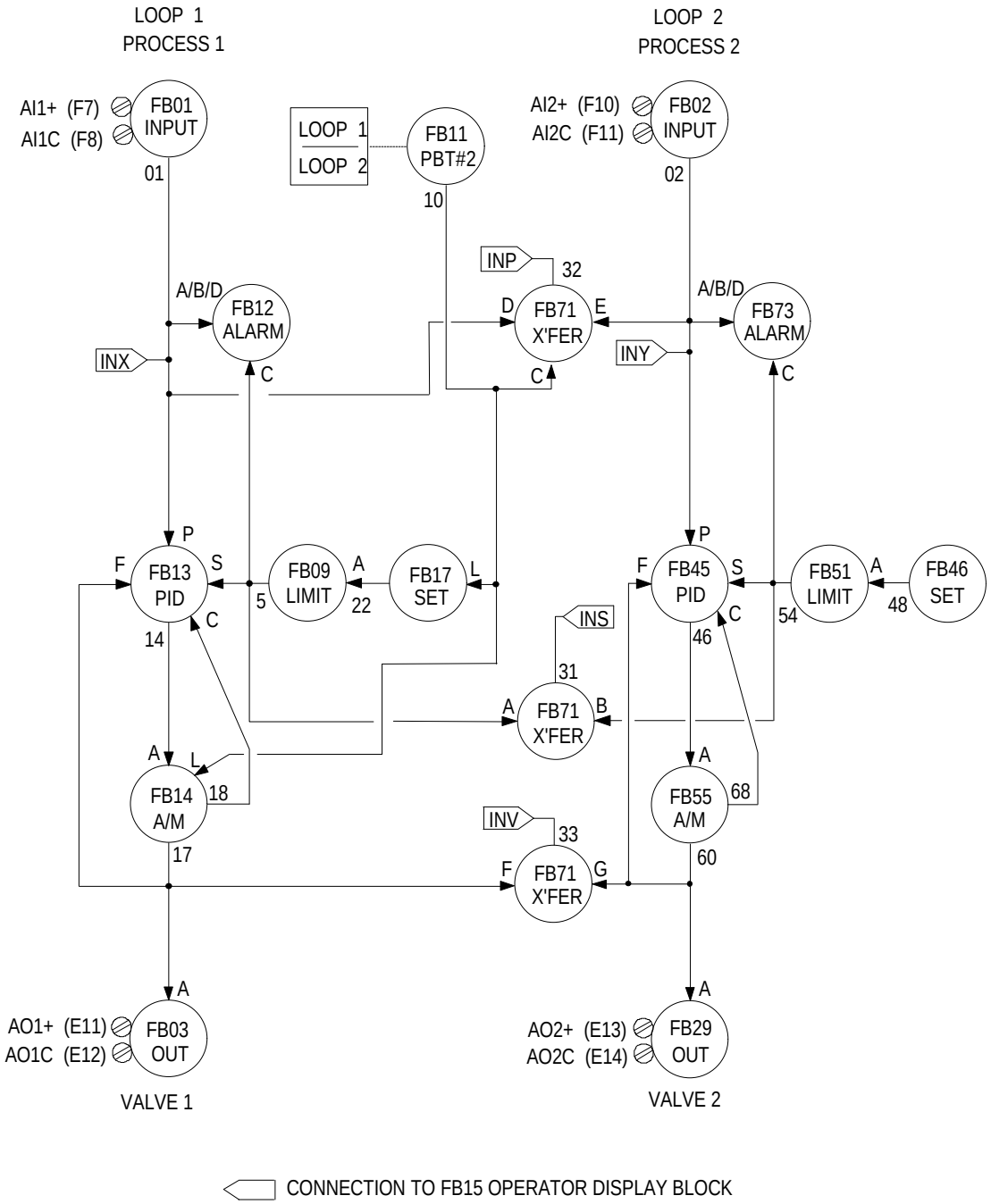
	T	H	S	C
FB73	ESN 76	Q5R 4 (%)	SA5 100.0%	
		Q6R 4 (%)	SA6 0.0%	
		Q7R 4 (%)	SA7 100.0%	
		Q8R 4 (%)	SA8 0.0%	
		A5T HI	DA5 0.5%	
		A6T LO	DA6 0.5%	
		A7T DEV	DA7 0.5%	
		A8T NONE	DA8 0.5%	
		INA 02	EA5 EN	
		INB 02	EA6 EN	
		INC 54	EA7 EN	
		IND 02	EA8 DIS	
		A5I 0.0 SEC		
		A6I 0.0 SEC		
		A7I 0.0 SEC		
		A8I 0.0 SEC		
		A5O 0.0 SEC		
		A6O O.O SEC		
		A7O 0.0 SEC		
		A8O 0.0 SEC		
		A5R NO		
		A6R NO		
		A7R NO		
		A8R NO		
FB98	ESN 90	H1P 01		
		H1S 05		
		H1V 17		
		H2P 02		
		H2S 54		
		H2V 60		
		POL 0		
		P1F USER		
		P2F USER		
		IND 00		
		INE 00		
		INF 00		
		ING 00		
		HTN HART TAG		
		DES HART DESCRIPTOR		
		MSG HART MESSAGE		
		DAT 01/01/93		
		DSN 0		

(continued on next page)

	T	H	S	C
FB98	ESN 90	VC1 3		
		VC2 4		
		VC3 5		
		VC4 0		
		RP 5		

9.15 FCO 26 2-LOOP PID CONTROLLER

With: Hi/Lo Process Alarms (Both Loops)
Deviation Alarm (Both Loops)
Non-Tracking Setpoints (Both Loops)
Setpoint Limits (Both Loops)
4-20 mA Inputs/Output
Model 348E Required for FCO26



CONFIGURATION PARAMETERS

	T	H	S	C
FB01	ESN 05	SRE NO	DV1 0 SEC	
FB02	ESN 07	SRE NO	DV2 0 SEC	
FB03	ESN 70	INA 17 INB 00		
FB09	ESN 34	DSD NO INA 22	LL1 0.00% HL1 100.00%	
FB11	ESN 55	EO NO PU LP S1A SUS DSD NO INE 00 INI 00 INA 00		
FB12	ESN 75	Q1R 4 (%) Q2R 4 (%) Q3R 4 (%) Q4R 4 (%) A1T HI A2T LO A3T DEV A4T NONE INA 01 INB 01 INC 05 IND 01 A1I 0.0 SEC A2I 0.0 SEC A3I 0.0 SEC A4I 0.0 SEC A1O 0.0 SEC A2O 0.0 SEC A3O 0.0 SEC A4O 0.0 SEC A1R NO A2R NO A3R NO A4R NO	SA1 100.0% SA2 0.0% SA3 100.0% SA4 0.0% DA1 0.5% DA2 0.5% DA3 0.5% DA4 0.5% EA1 EN EA2 EN EA3 EN EA4 DIS	

	T	H	S	C
FB13	ESN 60	C1T PID	A1 REV	
		MRT NO	PG1 1.00	
		INP 01	TI1 100 M/R	
		INS 05	TD1 0.00 MIN	
		INF 17	DG1 10.00	
		INA 00	MR1 0.0%	
		INC 18	HL1 100.00%	
			LL1 0.0%	
FB14	ESN 65	AO NO	PUM 0.0%	
		PU LP		
		PUL NO		
		INA 14		
		INT 00		
		INE 00		
		INS 00		
		INL 10		
FB15	ESN 40	INP 32	DP1 0.00	
		INS 31	PL1 0.00	
		INV 33	PH1 100.00	
		INX 01	DP2 0.00	
		INY 02	PL2 0.00	
		INA 00	PH2 100.00	
		INL 10	DPX 0.00	
		PDR L	XL 0.00	
		SDR L	XH 100.00	
		HS1 VALVE	DPY 0.00	
		HS2 VALVE	YL 0.00	
		HD1 YES	YH 100.00	
		HD2 YES	TST 10 SEC	
		SCF YES	TSI BOTH	
		IN1 00		
		IN2 00		
		U1S U1		
		U2S U2		
		TN1 LOOP 1		
		TN2 LOOP 2		
		EU1 PRCT		
		EU2 PRCT		
		EUX PRCT		
		EUY PRCT		
		FL1 A1		

(continued on next page)

	T	H	S	C
FB15	ESN 40	FL2 A2 FL3 A5 FL4 A6 FL5 NONE		
FB17	ESN 30	INT 00 INC 00 INL 10		
FB29	ESN 71	INA 60 INB 00		
FB45	ESN 45	C2T PID MRT NO INP 02 INS 54 INF 60 INA 00 INC 68	A2 REV PG2 1.00 TI2 100 M/R TD2 0.00 MIN DG2 10.00 MR2 0.0% HL2 100.00% LL2 0.0%	
FB46	ESN 25	INT 00 INC 00		
FB51	ESN 26	DSD NO INA 48	LL2 0.00% HL2 100.00%	
FB55	ESN 66	AO NO PU LP PUL NO INA 46 INT 00 INE 00 INS 00	PUM 0.0%	
FB71	ESN 36	INA 05 INB 54 IND 01 INE 02 INF 17 ING 60 INC 10		

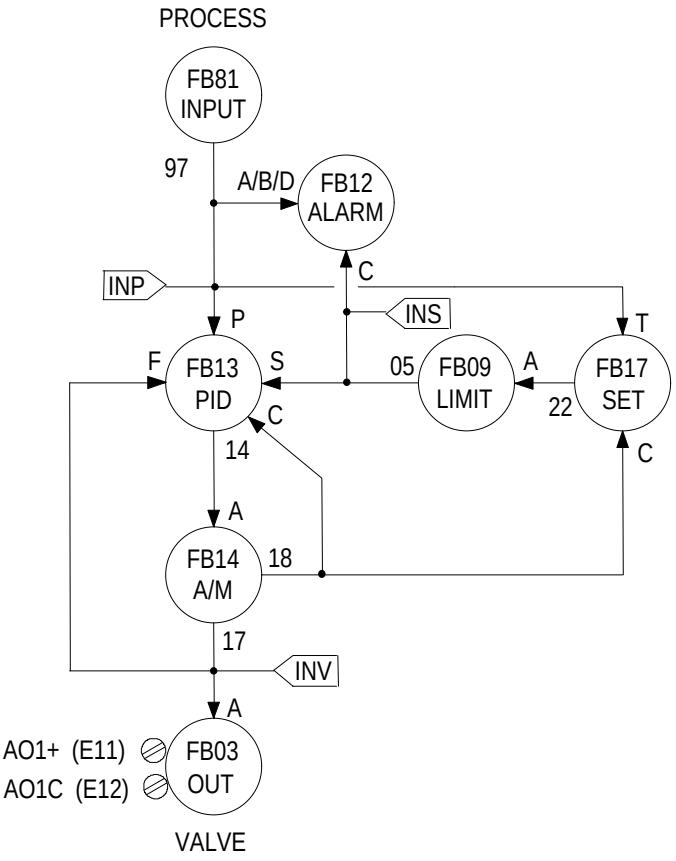
	T	H	S	C
FB73	ESN 76	Q5R 4 (%)	SA5 100.0%	
		Q6R 4 (%)	SA6 0.0%	
		Q7R 4 (%)	SA7 100.0%	
		Q8R 4 (%)	SA8 0.0%	
		A5T HI	DA5 0.5%	
		A6T LO	DA6 0.5%	
		A7T DEV	DA7 0.5%	
		A8T NONE	DA8 0.5%	
		INA 02	EA5 EN	
		INB 02	EA6 EN	
		INC 54	EA7 EN	
		IND 02	EA8 DIS	
		A5I 0.0 SEC		
		A6I 0.0 SEC		
		A7I 0.0 SEC		
		A8I 0.0 SEC		
		A5O 0.0 SEC		
		A6O O.O SEC		
		A7O 0.0 SEC		
		A8O 0.0 SEC		
		A5R NO		
		A6R NO		
		A7R NO		
		A8R NO		
FB98	ESN 90	H1P 01		
		H1S 05		
		H1V 17		
		H2P 02		
		H2S 54		
		H2V 60		
		POL 0		
		P1F USER		
		P2F USER		
		IND 00		
		INE 00		
		INF 00		
		ING 00		
		HTN HART TAG		
		DES HART DESCRIPTOR		
		MSG HART MESSAGE		
		DAT 01/01/93		
		DSN 0		

(continued on next page)

	T	H	S	C
FB98	ESN 90	VC1 3		
		VC2 4		
		VC3 5		
		VC4 0		
		RP 5		

9.16 FCO 31 Single-Loop PID Controller (TSP) – Pressure Input

With: Hi/Lo Process Alarms
Deviation Alarm
Tracking Setpoint
Setpoint Limits
4-20 mA Output



CONNECTION TO FB15 OPERATOR DISPLAY BLOCK

CONFIGURATION PARAMETERS

	T	H	S	C
FB03	ESN 45	INA 17		
		INB 00		
FB09	ESN 14	DSD NO	LL1 0.00%	
		INA 22	HL1 100.00%	
FB12	ESN 15	Q1R 4 (%)	SA1 100.00%	
		Q2R 4 (%)	SA2 0.00%	
		Q3R 4 (%)	SA3 100.00%	
		Q4R 4 (%)	SA4 0.00%	
		A1T HI	DA1 0.5%	
		A2T LO	DA2 0.5%	
		A3T DEV	DA3 0.5%	
		A4T NONE	DA4 0.5%	
		INA 97	EA1 EN	
		INB 97	EA2 EN	
		INC 05	EA3 EN	
		IND 97	EA4 DIS	
		A1I 0.0 SEC		
		A2I 0.0 SEC		
		A3I 0.0 SEC		
		A4I 0.0 SEC		
		A1O 0.0 SEC		
		A2O 0.0 SEC		
		A3O 0.0 SEC		
		A4O 0.0 SEC		
		A1R NO		
		A2R NO		
		A3R NO		
		A4R NO		
FB13	ESN 30	C1T PID	A1 REV	
		MRT NO	PG1 1.00	
		INP 97	TI1 100.00 M/R	
		INS 05	TD1 0.00 MIN	
		INF 17	DG1 10.00	
		INA 00	MR1 0.0%	
		INC 18	HL1 100.00%	
			LL1 0.00%	

	T	H	S	C
FB14	ESN 35	AO NO	PUM 0.00%	
		PU LP		
		PUL NO		
		INA 14		
		INT 00		
		INE 00		
		INS 00		
		INL 00		
FB15	ESN 40	INP 97	DP1 0.00	
		INS 05	PL1 0.00000	
		INV 17	PH1 100.000	
		INX 00	DP2 0.00	
		INY 00	PL2 0.00000	
		INA 00	PH2 100.000	
		INL 00	DPX 0.00	
		PDR L	XL 0.00000	
		SDR L	XH 100.000	
		HS1 VALVE	DPY 0.00	
		HS2 VALVE	YL 0.0000	
		HD1 YES	YH 100.000	
		HD2 YES	TST 10 SEC	
		SCF YES	TSI TN1	
		IN1 00		
		IN2 00		
		U1S U1		
		U2S U2		
		TN1 TAG NAME 1		
		TN2 TAG NAME 2		
		EU1 PRCT		
		EU2 PRCT		
		EUX PRCT		
		EUY PRCT		
		FL1 A1		
		FL2 A2		
		FL3 A3		
		FL4 NONE		
		FL5 NONE		
FB17	ESN 10	INT 97		
		INC 18		
		INL 00		

T	H	S	C
FB81 ESN 05	SRE NO		
FB98 ESN 90	H1P 97		
	H1S 05		
	H1V 17		
	H2P 00		
	H2S 00		
	H2V 00		
	POL 0		
	P1F USER		
	P2F USER		
	IND 00		
	INE 00		
	INF 00		
	ING 00		
	HTN HART TAG		
	DES HART DESCRIPTOR		
	MSG HART MESSAGE		
	DAT 01/01/93		
	DSN 0		
	VC1 3		
	VC2 4		
	VC3 5		
	VC4 0		
	RP 5		

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A.0 APPENDIX A - FIELDPAC FUNCTION BLOCKS

TABLE A-1 FIELDPAC Function Blocks

FB#	DESCRIPTION	OUTPUT IDENTIFICATION	COMMENTS	MODEL
01	Analog Input #1	Output: 01	N/A if 1/3-input P/I	S & E
02	Analog Input #2	Output: 02	N/A if 3-input P/I	S & E
03	Analog Output #1		Used by I/P option	S & E
04	Digital Output #1			S & E
05	Digital Output #2			S & E
06	Digital Input #1	Output: 16		S & E
07	Ratio	Output: 03 Track Output: 89		S & E
08	Bias	Output: 04 Track Output: 90		S & E
09	Hi/Lo Limit #1	Output: 05		S & E
10	Override Selector	Output: 07 OR Status: 08		S & E
11	PB Transfer #2	Output: 09 Status IS: 10 Status ES: 25		S & E
12	Alarm #1	Status AS1: 11 Status AS2: 12 Status AS3: 13 Status AS4: 91		S & E
13	PID Controller #1	Controller Output: 14 Error: 15		S & E
13	PD Controller #1	Controller Output: 14 Error: 15		S & E
13	ID Controller #1	Controller Output: 14 Error: 15		S & E

(continued on next page)

TABLE A-1 FIELDPAC Function Blocks (continued)

FB#	DESCRIPTION	OUTPUT IDENTIFICATION	COMMENTS	MODEL
13	PIDA Controller #1	Controller Output: 14 Error: 15		S & E
14	A/M Transfer #1	Output: 17 Status MS: 18		S & E
15	Operator Display	Error: 06 Pulse On: 19 Pulse Off: 26		S & E
16	Totalizer	P1 Status: 92 P2 Status: 93		S & E
17	Setpoint Track & Hold #1	Output: 22		S & E
18	General Purpose Track/Hold	Output: 23		S & E
19	General Purpose Hold	Output: 24		S & E
20	Logic #1	Output: 20		S & E
21	Logic #2	Output: 21		S & E
22	Deviation Amplifier	Output: 29		S & E
23	PB Transfer #1	Output: 27 Status IS: 63 Status ES: 64		S & E
24	Square Root Extractor	Output: 44		S & E
25	Analog Input #3	Output: 30		S & E
28	Pulse Integrator			S & E
29	Analog Output #2			E
30	Digital Input #2	Output: 58		S & E
32	Iso-Digital Output #1		Opto-Transistor in S Relay Contact in E	S & E
33	Iso-Digital Output #2		Opto-Transistor in S Relay Contact in E	S & E
34	Math Block #1	Output: 34		S & E
35	Math Block #2	Output: 35		S & E

(continued on next page)

TABLE A-1 FIELDPAC Function Blocks (continued)

FB#	DESCRIPTION	OUTPUT IDENTIFICATION	COMMENTS	MODEL
36	Math Block #3	Output: 36		S & E
38	Gain & Bias #1	Output: 38		S & E
39	Gain & Bias #2	Output: 39		S & E
40	Lag	Output: 40		S & E
41	Lead	Output: 41		S & E
42	Rate Limiter	Output: 42		S & E
43	Dead Time Table	Output: 43		S & E
44	10-Segment Characterizer #1	Output: 45		S & E
45	PID Controller #2	Controller Output: 46 Error: 47		S & E
45	PD Controller #2	Controller Output: 46 Error: 47		S & E
45	ID Controller #2	Controller Output: 46 Error: 47		S & E
45	PIDA Controller #2	Controller Output: 46 Error: 47		S & E
46	Setpoint Track & Hold #2	Output: 48		S & E
47	Repeat Cycle Timer	Output: 49		S & E
48	Logic #3	Output: 52		S & E
49	General Purpose Transfer	Output: 51		S & E
50	Logic #4	Output: 53		S & E
51	Hi/Lo Limit #2	Output: 54		S & E
53	Batch Switch	Output: 56		S & E
55	A/M Transfer #2	Output: 60 Status MS: 68		S & E
61	Logic #5	Output: 61		S & E
62	Logic #6	Output: 62		S & E

(continued on next page)

TABLE A-1 FIELDPAC Function Blocks (continued)

FB#	DESCRIPTION	OUTPUT IDENTIFICATION	COMMENTS	MODEL
64	Quad Comparator	Comparator 1: 80 Comparator 2: 81 Comparator 3: 82 Comparator 4: 83		S & E
65	Delay Timer	Output: 69		S & E
67	One Shot Timer	Output: 84		S & E
71	Dual Transfer Switch	Output 1: 31 Output 2: 32 Output 3: 33		S & E
72	10 Segment Characterizer #2	Output: 57		S & E
73	Alarm #2	Status AS5: 75 Status AS6: 76 Status AS7: 77 Status AS8: 78		S & E
75	Password Security			S & E
81	Pressure Sensor	Output: 97	Optional in S or E	
82	Temperature Sensor	Output: 98	Optional in S or E	
85	Pneumatic Input #1	Output: 85	Optional in S or E	
86	Pneumatic Input #2	Output: 86	Optional in S or E	
87	Pneumatic Input #3	Output: 87	Optional in S or E	
88	Logic #7	Output: 65		S & E
89	Logic #8	Output: 66		S & E
90	Logic #9	Output: 67		S & E
98	HART Communication	HART Status: 79 Output 70: 70 Output 71: 71 Output 72: 72 Output 73: 73 Output 74: 74		S & E

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APPENDIX B.0 MODEL 348 CONFIGURATION DOCUMENTATION

INSTRUMENT IDENTIFICATION

MODEL NO. _____ B/M NO. _____

SERIAL NO. _____ SENSOR MODEL NO. _____

SENSOR B/M NO. _____ SENSOR SERIAL NO. _____

TAG NO. _____

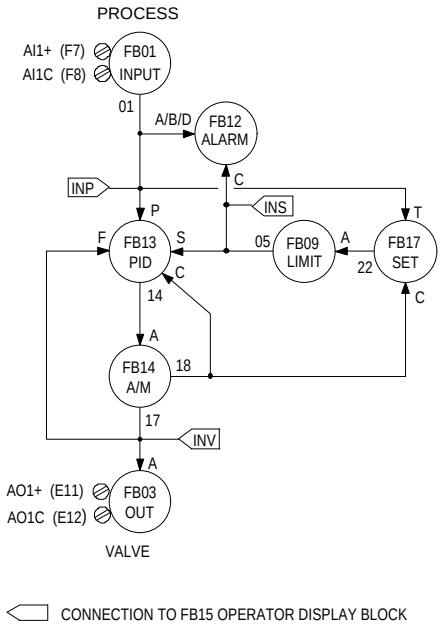
NOTES: _____

_____

_____

This appendix serves as a source document of configuration data for the Model 348 FIELDPAC Field Mounted Controller. All hard, soft, calibration and execution sequence parameters off all function blocks are listed on the following pages. However, the actual function blocks available in an individual controller will depend on the model number (including options). Enter your configuration data in the appropriate blocks and retain this document for future reference. Refer to Section 8 of this manual for further details of the function block parameter variables.

Space is provided at the end of this section to draw your configuration diagram. A sample diagram and a completed page is shown below.



	T		H		S		C	
FB01	ESN	05	SRE		DV1	0 SEC	ZI	
							FI	
FB02	ESN		SRE		DV2		ZI2	
							FI2	
FB03	ESN	45	INA	17			ZO1	
			INB	00			FO1	
FB04	ESN		INA					
FB05	ESN		INA					
FB06	ESN							
FB07	ESN		INA		R			
			INB		RRL			
			INC		RRH			
			IND					
			RCD					
FB08	ESN		OBR		B			
			INA					
			INE					
			INC					
			IND					
			BCD					
FB09	ESN	14	DSD	NO	LL1	0.00%		
			INA	22	HL1	100.00%		
FB10	ESN		S1B					
			S1C					
			DSD					
			INA					
			INB					
			INC					

	T		H		S		C	
FB01	ESN		SRE		DV1		ZI1 FI1	
FB02	ESN		SRE		DV2		ZI2 FI2	
FB03	ESN		INA INB				ZO1 FO1	
FB04	ESN		INA					
FB05	ESN		INA					
FB06	ESN							
FB07	ESN		INA INB INC IND RCD		R RRL RRH			
FB08	ESN		OBR INA INE INC IND BCD		B			
FB09	ESN		DSD INA		LL1 HL1			
FB10	ESN		S1B S1C DSD INA INB INC					

	T		H		S		C	
FB11	ESN		EO PU S1A DSD INE INI INA					
FB12	ESN		Q1R Q2R Q3R Q4R A1T A2T A3T A4T INA INB INC IND A1I A2I A3I A4I A1O A2O A3O A4O A1R A2R		SA1 SA2 SA3 SA4 DA1 DA2 DA3 DA4 EA1 EA2 EA3 EA4			

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	T		H		S		C	
FB12 (cont'd)			A3R A4R					
FB13	ESN		C1T MRT INP INS INF INA INC		A1 PG1 TI1 TD1 DG1 MR1 HL1 LL1			
FB14	ESN		AO PU PUL INA INT INE INS INL		PUM			
FB15	ESN	40	INP INS INV INX INY INA INL PDR SDR HS1 HS2		DP1 PL1 PH1 DP2 PL2 PH2 DPX XL XH DPY YL			

(continued on next page)

	T		H		S		C	
FB15 (cont'd)			HD1 HD2 SCF IN1 IN2 U1S U2S TN1 TN2 EU1 EU2 EUX EUY FL1 FL2 FL3 FL4 FL5		YH TST TSI			
FB16	ESN		CU TDD PCD INA INS INR		FS TB CM ZDO SV P1 P2 DIR			
FB17	ESN		INT INC INL		LS1 HS1			

	T		H		S		C	
FB18	ESN		INT INC HCD		H1			
FB19	ESN		HCD		H2			
FB20	ESN		LT1 INA INB					
FB21	ESN		LT2 INA INB					
FB22	ESN		INA INB INC		G1 B1			
FB23	ESN		EO PU S1A DSD INE INI INA					
FB24	ESN		INA					
FB25	ESN		SRE		DV3		ZI3 FI3	
FB28	ESN		INA INS		FS TB CM ZD PW			

	T		H		S		C	
FB29	ESN		INA INB				ZO2 FO2	
FB30	ESN							
FB32	ESN		INA A1					
FB33	ESN		INA A2					
FB34	ESN		O1A O1B INA INB INC		GO1 GA1 GB1 GC1 BO1 BA1 BB1 BC1			
FB35	ESN		O2A O2B INA INB INC		GO2 GA2 GB2 GC2 BO2 BA2 BB2 BC2			
FB36	ESN		O3A O3B INA INB INC		GO3 GA3 GB3 GC3 BO3 BA3			

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	T		H		S		C	
FB36 (cont'd)					BB3 BC3			
FB38	ESN		INA		GO5 GA5 BO5 BA5			
FB39	ESN		INA		GO6 GA6 BO6 BA6			
FB40	ESN		INA INB		TL			
FB41	ESN		INA INB		TH			
FB42	ESN		INA INB INC IND		TRU TRD			
FB43	ESN		INA INB INC		TM			
FB44	ESN		INA		X0 X1 X2 X3 X4 X5 X6 X7			

(continued on next page)

	T		H		S		C	
FB44 (cont'd)					X8 X9 X10 Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7 Y8 Y9 Y10			
FB45	ESN		C2T MRT INP INS INF INA INC		A2 PG2 TI2 TD2 DG2 MR2 HL2 LL2			
FB46	ESN		INT INC		LS2 HS2			
FB47	ESN		INA INB		TF TN			
FB48	ESN		LT3 INA INB					

	T		H		S		C	
FB49	ESN		INA INB INC					
FB50	ESN		LT4 INA INB					
FB51	ESN		DSD INA		LL2 HL2			
FB53	ESN		INA		BPL			
FB55	ESN		AO PU PUL INA INT INE INS		PUM			
FB61	ESN		LT5 INA INB					
FB62	ESN		LT6 INA INB					
FB64	ESN		C1A C2A C3A C4A INA INB		TC1 TC2 TC3 TC4 DC1 DC2			

(continued on next page)

	T		H		S		C	
FB64 (cont'd)			INC IND INE INF ING INH		DC3 DC4			
FB65	ESN		INA DTT OPU		DT			
FB67	ESN		INA		OT			
FB71	ESN		INA INB IND INE INF ING INC					
FB72	ESN		INA		X0 X1 X2 X3 X4 X5 X6 X7 X8 X9 X10			

(continued on next page)

	T		H		S		C	
FB72 (cont'd)					Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7 Y8 Y9 Y10			
FB73	ESN		Q5R Q6R Q7R Q8R A5T A6T A7T A8T INA INB INC IND A5I A6I A7I A8I A50		SA5 SA6 SA7 SA8 DA5 DA6 DA7 DA8 EA5 EA6 EA7 EA8			

(continued on next page)

	T		H		S		C	
FB73 (cont'd)			A6O A7O A8O A5R A6R A7R					
FB75	ESN		TPW APW SPW HPW CPW					
FB81	ESN		SRE		DVP MVU MVL MVH			
FB82	ESN		IT BOD		DVP MVU MVL MVH			
FB85	ESN		SRE		DV1		ZI1 FI1	
FB86	ESN		SRE		DV2		ZI2 FI2	
FB87	ESN		SRE		DV3		ZI3 FI3	
FB88	ESN		LT7 INA INB					

	T		H		S		C	
FB89	ESN		LT8 INA INB					
FB90	ESN		LT9 INA INB					
FB98	ESN		H1P H1S H1V H2P H2S H2V POL P1F P2F IND INE ING HTN DES MSG DAT DSN VC1 VC2 VC3 VC4 RP				

	T		H		S		C	

CONFIGURATION DIAGRAM

C.0 APPENDIX C - CABLE CAPACITANCE AND MAXIMUM LENGTH

A cable length calculation is necessary when HART communication is to be employed. Cable capacitance directly affects maximum Network length.

C.1 CABLE CAPACITANCE

Cable type, conductor size, and recommended cable model numbers are stated in Section 8.3.3 Two-Wire Cable.

Cable capacitance is a parameter used in the calculation of the maximum length of cable that can be used to construct the Network. The lower the cable capacitance the longer the Network can be. Manufacturers typically list two capacitance values for an instrumentation cable:

1. Capacitance between the two conductors.

2. Capacitance between one conductor and the other conductor(s) connected to shield. This capacitance is the worst case value and is to be used in the cable length formula.

C.2 MAXIMUM CABLE LENGTH CALCULATION

The maximum permissible single-pair cable length is 10,000 feet (3000 meters) or less as determined by the following formula:

$$L = \frac{65{,}000{,}000}{R \times C} - \frac{C_f + 10{,}000}{C}$$

Formula Definitions:

L: The maximum total length of cable permitted to construct the Network. L = Feet when C is in pF/ft. L = meters when C is in pF/meter.

R: The Network Resistance which is the ohmic sum of the Current Sense Resistance and Barrier Resistance (both Return and Supply), if any, in the Network and the resistance of the wire.

C: Cable capacitance per unit length between one conductor and the other conductor connected to the shield. C may be in pF/ft or pF/meter.

C_f: Total input terminal capacitance of Field Instruments; the Primary Master is excluded. C_f is given by the following formula:

C_f = (sum of all C_n values) x (5000)

Where C_n is an integer (e.g., 1, 2, 3) corresponding to the input terminal capacitance of a Field Instrument. C_n values are read from the following table. For Field Instruments without C_n values, use $C_n = 1$

FIELD INSTRUMENT CAPACITANCE	C_n VALUE
Less than 5000 pF	1
5000 pF to less than 10000 pF	2
10000 pF to less than 15000 pF	3
15000 pF to less than 20000 pF	4
20000 pF to less than 25000 pF	5
25000 pF to less than 30000 pF	6

Example Calculation:

Assume a Network consists of a 344 and a Field Instrument ($C_n = 1$ and $C_n = 6$).

Let R = 250W, C = 40 pF/ft., $C_f = (1 + 6) \times 5000 = 35{,}000$

$$\text{Then } L = \frac{65{,}000{,}000}{(250)(40)} - \frac{35{,}000 + 10{,}000}{40} = 5375 \text{ feet (1612.5 meters)}$$

■

WARRANTY

The Company warrants all equipment manufactured by it and bearing its nameplate, and all repairs made by it, to be free from defects in material and workmanship under normal use and service. If any part of the equipment herein described, and sold by the Company, proves to be defective in material or workmanship and if such part is within twelve months from date of shipment from the Company's factory, returned to such factory, transportation charges prepaid, and if the same is found by the Company to be defective in material or workmanship, it will be replaced or repaired, free of charge, f.o.b. Company's factory. The Company assumes no liability for the consequence of its use or misuse by Purchaser, his employees or others. A defect in the meaning of this warranty in any part of said equipment shall not, when such part is capable of being renewed, repaired or replaced, operate to condemn such equipment. This warranty is expressly in lieu of all other warranties, guaranties, obligations, or liabilities, expressed or implied by the Company or its representatives. All statutory or implied warranties other than title are hereby expressly negated and excluded.

Warranty repair or replacement requires the equipment to be returned to one of the following addresses:

Equipment manufactured or sold by MOORE PRODUCTS CO.

MOORE PRODUCTS CO.
Sumneytown Pike
Spring House, PA 19477 U.S.A.
Tel: +1 215 646 7400
Fax: +1 215 283 6340

Equipment manufactured or sold by MOORE PRODUCTS CO. (Canada) Inc.

MOORE INSTRUMENT LTD/LTEE
P.O. Box 370
Brampton, Ontario L6V 2L3, Canada
Tel: +1 905 457 9638
Fax: + 1 905 457 4182

Equipment manufactured or sold by MOORE PRODUCTS CO. (UK) LTD.

MOORE PRODUCTS CO. (UK) LTD
Copse Road,
Lufton Industrial Estate
Yeovil, Somerset BA22 8RN, England
Tel: +44 1935 706262
Fax: +44 1935 706969

The warranty will be null and void if repair is attempted without authorization by a member of the MOORE PRODUCTS CO. Service Department.

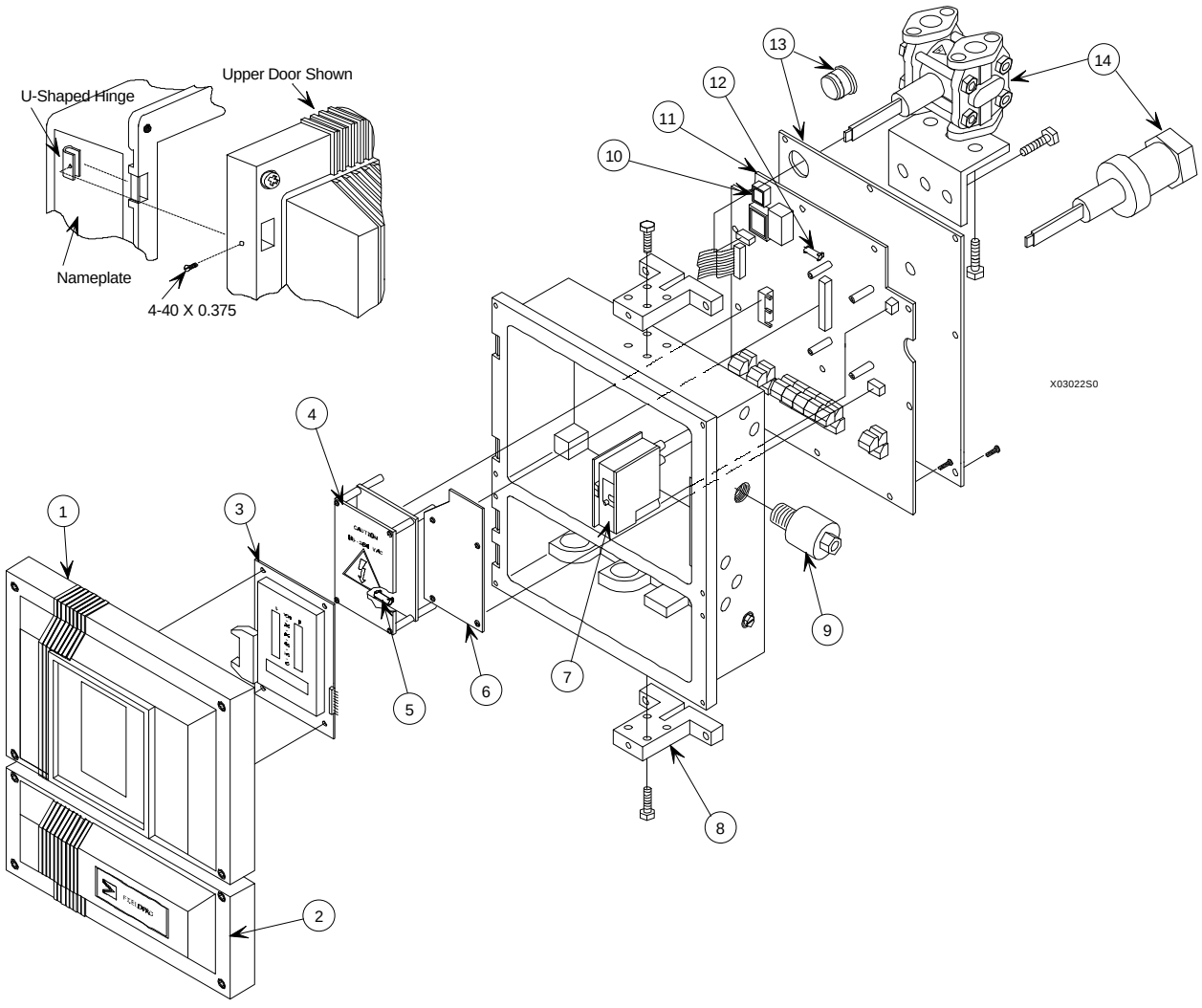
Process Automation Solutions

MODEL 348 FIELDPAC™ FIELD MOUNTED CONTROLLER

Drawing No. 348-1PL

PL348-1
Rev. 3
October 1998

MODEL 348 FIELDPAC™ FIELD MOUNTED CONTROLLER



ITEM	PART NUMBER	DESCRIPTION	QUANTITY
1	16161-181	Upper Door w/Keyboard, No Display	1
-	16161-226	Upper Door w/Keyboard, Non-Backlit Display	1
-	16161-227	Upper Door w/Keyboard, Backlit Display	1
2	16161-134	Lower Door (Terminal Compartment)	1
3	16161-223	Display with Backlight	1
-	16161-222	Display without Backlight	1
4	16161-25	90-264 Vac Power Supply Kit for all models except as follows	1
-	16161-239	90-264 Vac Power Supply Kit for CE and Type N approved models	1
5*	7447-209	Power Supply Fuse 120/240 Vac	1
6	16186-17	Thermocouple Board Kit	1
-	16205-51	Pneumatic 3-Input 3-15 psig Kit, Design Level B	1
-	16205-52	Pneumatic 3-Input 3-27 psig Kit, Design Level B	1
-	16205-53	Pneumatic 1-Input 3-15 psig Kit, Design Level B	1
-	16205-54	Pneumatic 1-Input 3-27 psig Kit, Design Level B	1
-	16205-55	Pneumatic 3-Input 3-15 psig Kit, Design Level A	1
-	16205-56	Pneumatic 3-Input 3-27 psig Kit, Design Level A	1
-	16205-57	Pneumatic 1-Input 3-15 psig Kit, Design Level A	1
-	16205-58	Pneumatic 1-Inout 3-27 psig Kit, Design Level A	1
7	15972-128	I/P Module 3-15 psig	1
-	15972-133	I/P Module 3-27 psig	1
8	16161-197	Mounting Bracket Kit, Standard Length	1
-	16161-88	Extended Mounting Bracket	2
9	16161-26	NEMA Type 4X Vent	1
10	16161-188	Software Update Kit (current controller software)	1
11	16288-1	Standard MPU Board	1
-	16288-21	Enhanced MPU Board	1
-	16288-31	Enhanced MPU Board for Type N approved models	1
12*	7447-167	MPU Board Fuse 500 mA	1
13	16161-12	Back Cover Plate, No Sensor	1
-	16161-82	Pressure Sensor Kit 340D or 340A/G with Tantalum Diaphragm, includes Backplate**	1
-	16161-83	Pressure Sensor Kit 340A/G, includes Backplate**	1
-	16161-186	Pressure Sensor Kit 340D or 340A/G with Tantalum Diaphragm, no Backplate**	1
-	16161-187	Pressure Sensor Kit 340A/G, no Backplate**	1
-	16161-122	Sensor Mounting Hole Plug Kit	1
14	-----	XTC Pressure Sensor - see GC MC-1, XTC Model 340, direct connect selections	1
---	1-0716	4-40 x 0.375 Flat Head SST Screw	4
---	16161-211	U-Shaped Metal Hinge	4

Notes to Parts List:

- Refer to Model 348 User's Manual UM348-1 before servicing the controller.
- See drawings above for controller disassembly and Item number reference.
- An * in the Item column identifies a recommended on-hand spare part. When ordering a spare or replacement part, provide the controller's complete model number, serial number and other nameplate information.
- ** - Separately order a Model 340 'direct connect' pressure sensor.

Process Automation Solutions

SOFTWARE RELEASE MEMO

SR348-3
Rev: 1
August 1998

Model 348 Moore FIELDPAC®
Software Version 1.05

PRODUCT INVOLVED

A Model 348 Moore FIELDPAC Field-Mounted Controller with MPU controller board V1.05 software (firmware).

INTRODUCTION

This Software Release Memo discusses functional and performance enhancements incorporated in MPU Controller board software (firmware) version 1.05. It also contains a list of materials needed to upgrade a controller having earlier software. If this paper accompanies a controller shipment, V1.05 is installed on the MPU Controller Board.

Software version 1.05 replaces all previous versions (V1.01, V1.02, V1.03 and V1.04). Configurations created with the previous versions are compatible with V1.05.

Contact your local sales office for price and delivery if you have a controller with earlier MPU Controller Board software.

ENHANCEMENTS

The primary purpose of this V1.05 software is to support new Analog to Digital (ADC) & Digital to Analog (DAC) Converters included on the MPU board shipped after June, 1998. Some enhancements and operational considerations from previous releases were also addressed.

- **Factory Configured Option (FCO31)** was added. This is a Single-Loop PID Controller (TSP) with a direct process pressure input (FB81).
- **Two outputs** were added to FB81, Process Pressure Sensor function block: Capsule Temperature (55) and Static Pressure (50). These parameters must be entered from the front faceplate.
- **Two HART® Variable Codes**, Static Pressure (9) and Capsule Temperature (10) were added to FB98.
- **New power up error codes** were added to the error code table.

- **Function Block FB42** now has a valid ramp down time of 0.0.
- **Ratio** is now displayed on-line & during configuration with two decimal places.
- **Optional sensor inputs** will now power up with error codes and will not remove the configuration until the user acknowledges the error.
- **The LEDs** associated with the E/I switch now show the correct position of the E/I switch, and not the status of the E/I function block.

OTHER ENHANCEMENTS

Version 1.05 software includes the following previous software enhancements. Version 1.05 software will update any of the previous versions to version 1.05 without having to install each previous software version.

Version 1.04 software enables a Model 348 to accept a Model 340 pressure capsule that has an EMO (Enhanced Multi-Mode Oscillator). The new EMO compensation method provided by the software improves the ambient temperature performance when using a new EMO capsule. V1.04 software is compatible with older 340 capsules which use an MMO.

V1.03 enhancements to V1.02 release provides greater reliability and more robust operation of the HART communications circuit.

- **VIEW mode** will display NAN when the block output is the IEEE representation of "not a number."
- **When both A/M blocks** are used, FIELDPAC displays the appropriate A/M annunciator for the current loop being viewed. When one of the A/M blocks is removed from execution, that annunciator is no longer displayed with its associated loop.
- **When an FCO** is stored and alarms are active, alarm status words are updated.
- **User 1 and User 2 Status** bits can be accessed via HART. A higher level device can now access these status bits.
- **Valve action** is now included in the Loop Status Word via HART.

V1.03 enhancements to V1.01 include the above plus the following:

- **FB98 parameters** (Outputs 70, 71, 72, 73, & 74) are now non-volatile.
- **The VIEW mode** now times out after 3 minutes.
- **Setpoint function blocks FB17 and FB46** will respond to a HART command from a higher level device to START A RAMP.
- **Rate Limiter FB42** can limit the RAMP RATE DOWN at times other than 0.0 minutes.
- **The B HI/LO Selector** in FB10 can now function as a LOW selector when configured as such.

- **The following changes** have been made to FCO 20:
  - FB45 HINS = 54 , not 09
  - FB73 HINC = 54, not 09
  - FB51 HINA= 09, not 48
  - FB98 H2S= 09, not 54

- **Rate Limiter FB42** will now track when the Adaptive input = 0%.

- **The Configuration Hold** bit is now reset after a display test.

- **Several Alarm enhancements** and corrections were made:
  - Alarm trip points are set in % in the configuration mode.
  - Alarm Not Acknowledged (NAK) bit now functions properly.
  - Alarms no longer ring after the function block is removed from configuration.
  - The decimal point position in Quick Alarm matches the position in engineering units when configured to display in engineering units.

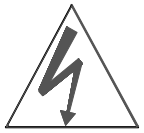
UPGRADE MATERIALS NEEDED

- FIELDPAC Software Update Kit P/N16161-188 with the following three items:
  - ROM extraction tool (P/N16161-183)
  - V1.05 ROM
  - *Software Release Memo* (SR348-3)
- *Model 348 User's Manual* (UM348-1)
- Phillips-head screwdriver to open upper door

INSTALLATION PROCEDURE

Refer to the Model 348 User's Manual (UM348-1) and proceed with the following:

1. Remove power from the controller.



WARNING

Electrical shock hazard. Remove electrical power before proceeding.

2. Open the upper door.

3. Snap on a wrist strap grounded to an unpainted area on the controller. Refer to Figure 1 and locate U48.

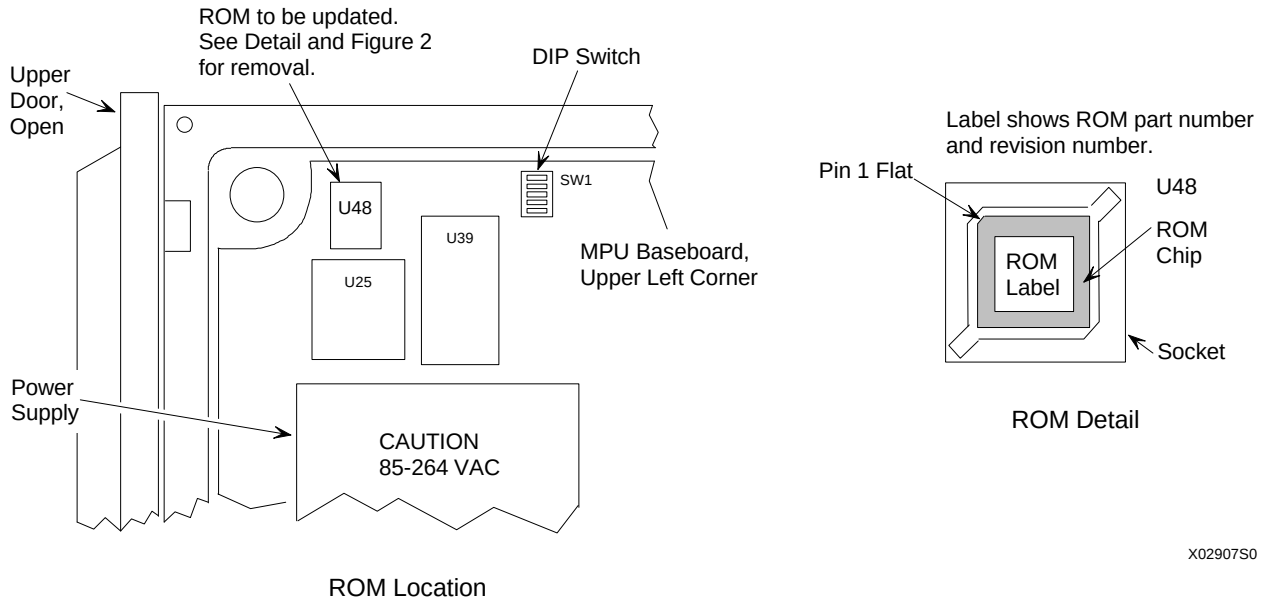


FIGURE 1 ROM Location and Labeling

4. C*arefully* remove the installed ROM (U48) using the extraction tool provided. See Figure 2 for details.

IMPORTANT

If care is not taken, the ROM's socket may be damaged. Such damage cannot be repaired in the field.

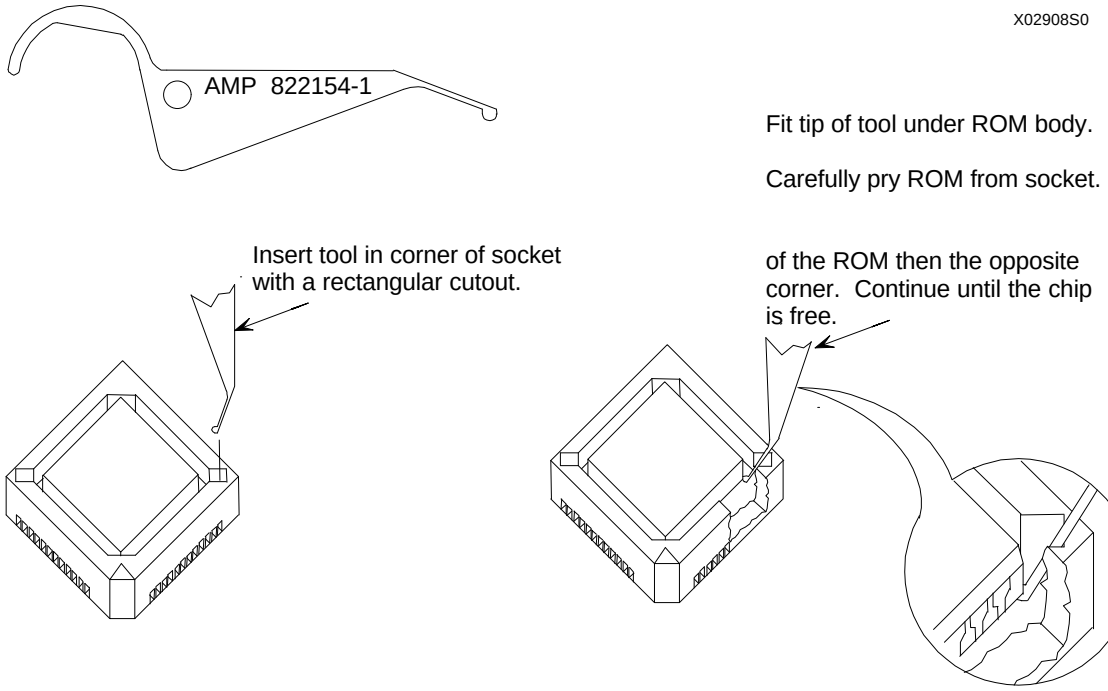

X02908S0
AMP 822154-1
Fit tip of tool under ROM body.
Carefully pry ROM from socket.
Insert tool in corner of socket
with a rectangular cutout.
of the ROM then the opposite
corner. Continue until the chip
is free.

FIGURE 2 ROM Removal

5. Using the “Pin 1 Flat” on the ROM for reference, carefully orient the supplied V1.05 ROM with the socket and press it in. Be certain that the ROM is fully and evenly inserted in the socket.
6. Remove the wrist strap and close and secure the upper door.

   The update is complete. The Controller’s configuration and calibration will not be affected by this update.

7. Apply power to the Controller and verify that it is operational. Edit the configuration as desired to take advantage of the enhancements. Discard the V1.01, 1.02, V1.03 or V1.04 ROM.

8. Complete and mail the software registration card.

■

Procedures in this document have been reviewed for compliance with applicable approval agency requirements and are considered sound practice. Neither Moore Products Co. nor these agencies are responsible for repairs made by the user.
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Siemens Energy & Automation	USER'S MANUAL ADDENDUM

UMA348-1-3
Rev: 1
December 2003

MODEL 348E FIELD MOUNTED CONTROLLER INSTALLATION IN THE PRESENCE OF ACETIC ACID

INVOLVED MANUAL

UM348-1, *Model 348 Field Mounted Controller User's Manual*, Issue 4

DISCUSSION

The following statement modifies Sections 1.3.4 Environment, 1.3.5 Hazardous Area Classification, and 2.0 Installation of the above manual and applies to U.S. installations only:

A Model 348E may not be installed in a Division 2 hazardous area when acetic acid is present.

■